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THE JOURNAL OF
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FOUR POSITIONS ON JAPANESE FINANCE*

M. BRONFENBRENNER
University of Wisconsin; *pro tem*, Tokyo, Japan

Bushi wa kuwanedo takayōji, "The starving samurai flourishes his toothpick."—OLD JAPANESE PROVERB.

I. THE ISSUES

THE problems of Japanese financial reconstruction involve issues which transcend in interest the Island Empire and are worthy of consideration in a broader setting.

Because of the war, Japan has suffered a serious drop in her national product and living standards. Perhaps a quarter of the national capital was destroyed or worn out in the course of the war; and as much again was wasted in weapons of war, munitions, or overseas ventures which ended in abject failure.[1] In late 1949, after four years of reconstruction, the standard of living as measured by real consumption expenditures per capita is estimated by the Japanese Economic Stabilization Board (ESB) at only 70 per cent of prewar.[2] Again because of the

* All views expressed herein, likewise all errors of fact or interpretation, are the writer's and do not represent any section or division of the SCAP organization. He wishes to acknowledge, however, the assistance and criticism of numerous authorities within both the SCAP organization and Japanese economic circles, many of whom have requested that their names be withheld.

[1] ESB, *Overall Report on Damages Japan Sustained from the Pacific War* (mimeographed summary; Tokyo, April, 1949), gives a breakdown in billions of yen, as follows:

Damage to civilian capital		4,245
Bombing and fire	3,200	
Deterioration, etc.	1,000	
Postwar dislocation	45	
Damage to war vessels and airplanes		2,600
Remaining general national assets		12,300

It is noted further that "if damages to other fighting weapons be added thereto, the total figure [for war instruments] will be almost equal to that of the damages to peaceful national wealth" (*op. cit.*, p. 7), and that "the figures do not include the losses of intangible properties and of overseas assets which are difficult to survey" (*ibid.*, p. 1).

[2] "The Economic Stabilization Board has presented to GHQ data showing that the national livelihood of the Japanese people in the 1949 calendar year recovered to the level of 70 per cent of the prewar index years 1934–36" (*Nippon Times*, March 11, 1950). A further 10 per cent increase is forecast for the fiscal year ending March 31, 1951, by ESB

war and its financing, Japan fell into a destabilizing inflation, admittedly not approaching the Chinese or Hungarian in severity but, nevertheless, an inflation which increased prices to somewhat over two hundred times their prewar level.[3]

In any country in this position, not merely in Japan, the responsible authorities were bound to inquire whether recovery should be sought before stability, or stability before recovery, or whether both might perhaps be achieved at the same time. Everyone wants both recovery and stability eventually, but different thinkers have different views regarding the order of achievement. The argument for placing stability first is primarily economic in character. No sound and durable recovery, it is argued, can be expected (at least no sound and durable recovery dependent on private capital investment) until the economy has been stabilized sufficiently to reduce to manageable size the risk involved in economic calculation. The social and political implications of "stability first" are weighted on the conservative side, especially in slowing down reform programs which may destabilize in the short run. The argument for primary emphasis on recovery, on the other hand, is primarily political and social. No populace with any voice in its own affairs, it is argued, can be expected to accept even temporarily whatever sacrifices may be involved in stabilization until its business activity and/or its living standards have returned to levels which are considered acceptable, i.e., which have been reached in the recent past and are regarded as relatively normal. As between these two aspects of "recovery"—business activity and living standard—there is a further division between the right and the left wing of the "recovery" partisans. We have, in fact, to deal with essentially three positions: "stability first," "business recovery first," and "consumption recovery first."

Because of the war, and more particularly because of its loss by Japan, the Japanese economy is being reconstructed or "reformed," almost from the bottom up. In any country in this position, again not merely in Japan, another equally basic and unpleasant question is the following: In framing the revised economic system, to which of three major evils will it be necessary to reconcile one's self in seeking to avoid the other two? The three evils or, at least, risks which are involved may be listed as (*a*) the risk of periodic depression, with unemployment which may become severe; (*b*) the risk of a price level generally rising fairly steeply —"permanent" or stair-step inflation; (*c*) the risk of economic, and eventually of political, dictatorship through detailed controls over allocations, outputs, prices, and wages.

Director-General Takayoshi Aoki (*ibid.*, January 26, 1950).

A more precise percentage of 69.2 is to be found in the Economic Rehabilitation Planning Committee, ESB, *Report, Part I* (Tokyo, 1949), p. 20. These calculations, however, did not include housing.

There is no real conflict between these ESB figures and the SCAP estimates, which show production as having revived to the 1934–36 level (PIO, GHQ, SCAP, Press Release, February 6, 1950). The consumption data are per capita and the production figures over-all—an important distinction in view of the 20 per cent population increase between 1935 and 1950. Further, consumption data include imports, and Japan's import trade is greatly reduced since the war. Finally, the production figures include capital goods, exports, and additions to stockpiles, none of which find their way into immediate consumption. Cf. "Gap between Production and Living," *Mainichi*, February 15, 1950.

[3] As of October, 1949, the wholesale price index for Japan stood at 213.1 times the 1934–36 average and the consumer's price index for Tokyo at 203.1 times this average. Both indexes include black-market, as well as official, prices (Programs and Statistics Division, Economic and Scientific Section, GHQ, SCAP, *Japanese Economic Statistics*, XXXIX, Part III, pp. 18, 28).

It is demonstrably possible to avoid any two of these risks at the cost of accepting the remaining one. No economic system has yet been suggested which I accept as avoiding all three efficaciously rather than through pious verbiage. Thus the American New Deal has chosen to avoid the first and (in peacetime) the third of these risks, using deficit financing to remedy depression but never carrying anti-inflationary monetary and fiscal policies far enough to threaten seriously the level of employment.[4] As a result, America now finds itself threatened by the second risk, the spiral of inflation. The conservative opposition in America would prefer to see the United States avoid the second and third risks but either ignores the first risk (of cyclical instability) or accepts it with relative equanimity. The socialist and the communist regimes of Europe, from Great Britain to the Soviet Union, are alike in avoiding the first and second risks but accepting the third in varying degree.

These, then, are the two groups of basic economic issues facing Japan at the present time: on the one hand, stabilization versus business recovery versus consumption recovery; on the other hand, the business cycle versus secular inflation versus economic regimentation within a pliable economy which can be fitted with almost equal ease into a free enterprise, a welfare state, a planned economy, or a traditional Japanese feudal pattern. We can fit the four leading viewpoints on Japanese financial and economic reconstruction into the pattern of possible solutions for these issues, with results which seem significant not only for Japan herself but also for other countries similarly situated, in which similar positions are apt to find support.

[4] The writer has discussed this policy at greater length elsewhere: M. Bronfenbrenner, "Post-War Political Economy: The President's Reports," *Journal of Political Economy*, October, 1948.

II. THE DODGE LINE

The *Dodge Line*, named for Mr. Joseph M. Dodge, of Detroit, who has served as special economic adviser to General MacArthur, is the ruling position within SCAP, including particularly those divisions of SCAP's Economic and Scientific Section which deal with financial matters. It is also accepted by the cabinet of Premier Shigeru Yoshida.

Combined with the SCAP–National Advisory Council "Nine-Point Economic Program" of January, 1949,[5] the Dodge position is essentially that stabilization must precede recovery, since

[5] The "Nine Commandments," as expressed by General MacArthur in a letter to Premier Yoshida in December, 1948, were published in the *Oriental Economist*, January, 1949, as follows:

"*a*) Achieving a true balance in the consolidated budget at the earliest possible date by stringent curtailing of expenditures and maximum expansion in total governmental revenues, including such new revenues as may be necessary and appropriate.

"*b*) Accelerating and strengthening the program of tax collection and insuring prompt, widespread, and vigorous prosecution of tax evaders.

"*c*) Assuring that credit extension is rigorously limited to those projects contributing to the economic recovery of Japan.

"*d*) Establishing an effective program to achieve wage stability.

"*e*) Strengthening and, if necessary, expanding the coverage of existing price control programs.

"*f*) Improving the operation of foreign trade controls and tightening existing foreign exchange controls, to the extent that such measures can appropriately be delegated to Japanese agencies.

"*g*) Improving the effectiveness of the present allocation and rationing system, particularly to the end of maximizing exports.

"*h*) Increasing production of all essential indigenous raw materials and manufactured products.

"*i*) Improving the efficiency of the food collection program."

This program on paper is more devoted to controls and less to free enterprise than it has worked out in practice. After the arrival of Mr. Dodge, the "increased controls" aspects of the Nine-Point Program were de-emphasized somewhat relative to the remainder.

recovery requires investment that will not be forthcoming until Japan's price level is stabilized and her foreign exchange position tenable without American aid. Self-support, then, is to be sought at living standards materially below prewar. As regards the second group of issues, the Dodge position is that both continued inflation and economic regimentation should be avoided. It has, however, been hesitant with regard to the removal of controls, particularly over the dollar exchange, which is critically short and is being supplemented on a relief basis through the GARIOA program.[6]

The Dodge Line faces the threat of deflation and unemployment with its eyes open, deliberately retiring government debt in a "super-balanced budget" for the purpose of producing "tight money."[7] Many feel that the threat of depression and unemployment may do Japan positive good in the present situation by increasing industrial efficiency, productivity, and self-reliance. In particular, it may weaken the paternalistic Japanese reliance on government intervention to support all major industries and the paternalistic Japanese tradition against dismissing labor except for personal cause. At any rate, such unemployment as may arise should be relieved only by direct relief in the short run and through industrial rationalization (cost-cutting), which will expand the market over the longer period. Such "soft-money" expedients as deficit financing of postponable public works or promotion of exports through further devaluation of the yen are definitely contrary to the Dodge prescription. The Shoup Report on tax reform,[8] although not part of the Dodge Line in all its details, is consistent with it in providing revenue adequate for the "super-balanced budget" and in denying that the resulting Japanese tax burden is excessive.[9]

[6] The Dodge program also called for the establishment of a single yen-dollar exchange rate to replace the then-existing multiplicity of commodity export and import rates. A uniform over-all rate of ¥ 360 to the dollar was in fact inaugurated in April, 1949, thereby diminishing the area of direct controls. Commodity exports have subsequently been liberalized, notably by the removal of "floor price" provisions, so that Japanese export trade is moving toward a free market basis. Commodity imports and capital movements in both directions remain under strict regulation. The attacks on SCAP economic policies which appeared in American magazines (*Fortune*, *Look*, etc.) during 1949 were inspired chiefly by a desire for more rapid decontrol of Japanese foreign trade.

[7] The debt-retirement account in the Japanese budget for fiscal 1950–51 is somewhat complex. The national government proposes to retire ¥ 127 billion of debt, mainly held by the banks. Of this amount, however, only ¥ 77 billion is to be financed by receipts in the general and special accounts; the remaining ¥ 50 billion is to be financed by the sale of goods provided by the United States under the GARIOA program. Net borrowings of ¥ 30 billion, however, are estimated for Japanese prefectural and municipal governments, so that net government debt retirement locally financed is reduced to ¥ 47 billion. Furthermore, the budget makes no provision for service on Japan's prewar foreign currency debt or for the accumulation of a reserve against which war-damage claims against Japan can be met. Such provisions would have eliminated the debt-retirement account completely.

It is partially because of their belief that the debt retirement is more apparent than real that Dodge Line supporters oppose drawing down the retirement account to increase the basic wages of government employees to the amounts recommended by the National Personnel Authority in December, 1949.

[8] Carl S. Shoup *et al.*, *Report on Japanese Taxation* (4 vols.; Tokyo: GHQ, SCAP, 1949).

[9] The Shoup Mission points out (*ibid.*, Vol. I, pp. 7 f.) that taxes comprise approximately 20 per cent of Japan's national income, as compared with a figure of 24 per cent for the United States and 35 per cent for the United Kingdom. The Japanese Left, on the other hand, compares tax burdens in various countries with national consumption other than food purchases (which are taken as roughly equivalent to minimum subsistence). Approximately 65 per cent of Japanese personal consumption is currently for food (Institute of World Economics, *Economic Condition of Present Day Japan* [Tokyo, 1949], p. 32), which means that taxes comprise nearly 60 per cent of the remainder. This is a figure difficult to duplicate elsewhere.

This austerity program is more reminiscent of the "Dismal Science" than of the "Economy of Abundance," of Gladstone than of Roosevelt. In considering it, one should remember that many of the Americans involved in framing and implementing the Dodge Line have an investment or banking background which influences their politics and economics and that the operations of SCAP are proconsular in their independence from Washington. We should therefore not be surprised, as are some Japanese observers, to find portions of the Dodge Line imperfectly consistent with the policies which the national administration is contemporaneously applying in the continental United States. Indeed, not the least interesting aspect of the Dodge Line to Americans is as an orientalized picture of what domestic economic policy might now be if the 1948 elections had proceeded according to the Gallup Poll, and also as a test-tube version of what it may become in the future if financiers increase their influence in its framing.

While criticism is not my primary purpose here, it may be permissible to inject the personal opinion that the Dodge Line might be more palatable to the Japanese if it included as complete a prescription against hyperdeflation as against hyperinflation. Suppose, for example, that a real "crisis" develops and deflation gets out of control on a scale which cannot be handled by Counterpart Fund credits;[10] it will be desirable to know what price level the Japanese government will have been urged to support. Japanese business and labor leaders can hardly be expected to react quickly to "tight money" by cutting their prices and wages, as it is hoped they will do, if these cuts will set off a chain of elastic expectations in a downward direction, whose end depends on acts of God and the Pigou effect.

III. THE ISHIBASHI LINE

If the present Japanese government and the dominant Liberal party were operating without consultation with SCAP on economic matters, many believe that there would be a reversion to policies associated with the name of Tanzan Ishibashi.[11] Mr. Ishibashi, former editor of the influential *Oriental Economist*, was for a time economic spokesman for Japanese big business. He held the key post of finance minister in the first Yoshida Cabinet during the period of most rapid Japanese postwar inflation but was removed in 1947 under charges of obstructing SCAP policies. The *Oriental Economist* remains the most effective English-language proponent of his views.

Mr. Ishibashi calls himself a Keynesian. His Keynesianism, however, is of a fundamentalist variety which takes literally the view that *no* monetary expansion should be considered inflationary so long as production and employment are increasing along with prices. His critics call him an inflationist—more specifically, a profit inflationist. Western readers may perhaps consider him a latter-day oriental John Law. His *Ishibashi Line*, influential despite the per-

[10] Proceeds from the sale of Japan's GARIOA imports from the United States are segregated in a special account known as the Counterpart Fund and supervised by SCAP officials. Control of the return flow of these funds to the Japanese economy, either directly or through the commercial banks, is a further stabilizing factor in the Dodge Line. Increasing the size and rapidity of the flow, in particular, is its major antideflationary weapon.

[11] Support for the surmise in the text appears in the form of pressure from Liberal party circles for the special meeting between Mr. Dodge and Finance Minister Hayato Ikeda, in which Mr. Ikeda urged lessened rigor in applying the Dodge stabilization policies. This meeting was held in May, 1950, with results not yet apparent as this article goes to press.

sonal eclipse of its author, differs from the Dodge Line basically in seeking business (though not consumption) recovery before stability and in preferring rising prices to either underproduction or underemployment. It is even more "free enterprise" in its opposition to controls, either direct or over-all,[12] upon the activities of the businessman or upon individual bargaining in labor relations.

To supporters of the Ishibashi Line, recovery depends upon increased production. This depends, in turn, upon capital accumulation, which can be encouraged by high rates of profit even when basic raw materials are physically short. In financing capital accumulation, taxes are to be kept low while easy credit is made available from a Reconstruction Finance Bank. The budget is to be unbalanced deliberately. Foreign exchange is to be secured by yen devaluation and "exchange dumping" to whatever extent is necessary. Full employment is to be assured by monetary expansion and curbs on trade-union wage-raising activity. Official prices, if they cannot be eliminated altogether, are to be fixed at premium rates high enough above production cost to encourage increased output. Far from opposing price increases, the Ishibashi Line rather welcomes their effect on production, denies their long-run inflationary character, and tries to close its eyes to the resulting concentration of the cost of reconstruction upon consumers and upon labor. Under consumer and labor pressure, however, the Ishibashi Line tolerates subsidies to hold down particular prices, provided that they are financed by deficits rather than by taxes—provided, in other words, that they exercise no net contraction effect.

[12] As regards over-all controls, Mr. Ishibashi opposed not only the curtailment of bank-loan expansion during his tenure as finance minister, but also anti-inflationary taxation of types which, like the capital levy, fall primarily upon the wealthy.

IV. THE ESB LINE

A third financial line is associated with the Economic Stabilization Board (ESB), although the ESB supported it whole-heartedly only during the Katayama (Socialist) Cabinet of 1947–48. The ESB occupies in the Japanese government a position somewhat analogous to that of the Council of Economic Advisers in the American government, with the important difference that the present cabinet is less frequently in sympathy with its views than is the present American executive with the positions of the CEA.

What we are calling the *ESB Line* is closer to the American New and Fair Deals than is the Dodge Line, and closer to the British Labour party than to the American New Deal. It has minority support within SCAP and comes close to being the official position of all wings of Japan's divided Socialist party. Its foremost Japanese advocate in dealing with the Occupation has been Professor Shigeto Tsuru, formerly vice-minister within ESB and author of the standard treatise on the Japanese postwar inflationary experience.[13]

Here, again, we find recovery before stability, but this time it is standard-of-living rather than business recovery which is desired. Again capital investment is regarded as the key to recovery, but under this approach this capital is to be supplied largely by government investment in public works and in new industries. International loans are to be

[13] An English edition of Professor Tsuru's *Sengo Nippon no "Inflation"* (Tokyo: Iwanami, 1949), revised and brought down to the end of the fiscal year 1949–50, is expected to appear under Institute of Pacific Relations auspices during 1950. For an interim illustration of his thinking see his essay "Toward Economic Stability in Japan," *Pacific Affairs*, XXII (December, 1949), 357–66.

sought for Japanese government enterprises, including wholly owned government corporations. Dependence on private capital, either domestic or foreign, is to be avoided. Equilibrium of the Japanese international accounts is to be postponed until living standards are approximately prewar. Mass consumption is to be maintained or increased, meanwhile, by keeping wages high relative to profits,[14] by low taxes on low-income consumers, and by subsidies to hold down the prices of the principal consumer goods, even at the cost of substantial budgetary deficits.

In so far as this policy, too, runs the risk of continued inflation, it is more a *consumption* and less an *investment* inflation than that generated by the Reconstruction Finance Bank lending of the Ishibashi policies. It is also to be repressed as far as possible by the detailed and direct economic controls familiar to Americans and Englishmen. In so far as open inflation is permitted to slip through the interstices of the control network or has already developed before controls begin to operate, reliance is to be placed on a capital levy or on a currency conversion *after* stabilization in order to recapture the unearned profits of those who guess right on the course of the inflation.[15] The risk accepted by the ESB Line is the risk of eventual economic and political dictatorship. Supporters of this position in Japan, along with democratic socialists in other countries, refuse to take this threat seriously.

V. THE COMMUNIST LINE

The Japanese Communist party presents a fourth viewpoint, characteristically its own. This *Communist Line* suffers somewhat from statistical irresponsibility in that its optimism is dependent upon estimates which are presented without adequate supporting evidence, at least in the presentations which I have seen.[16] According to the Communist Line, recovery and stability can be achieved simultaneously; the apparent conflict between them is only an aspect of the "contradictions of capitalism." They can be achieved simultaneously by a series of measures. One is an ambitious public works program, aimed primarily at re-

[14] The dominant Japanese labor view regarding wage increases is familiar to American readers from the several "Nathan Reports." Employers are to be compelled by price controls to pay wage increases "out of profits." The effect of such increases upon other prices is described as "neutral," since profits fall as wages rise and there is allegedly (at least during an inflation) no difference in the propensity of the alternative recipients to spend the increments of income. Should a recession set in, the workers' propensity to spend, it is believed, would remain high while that of the profit recipients would fall off. The higher propensity to spend resulting from redistribution in favor of labor is then relied on as an important recovery factor. For recent American controversy regarding this position see Sumner H. Slichter, "Raising the Price of Labor as a Method of Increasing Employment," *Review of Economics and Statistics*, XXXI (November, 1949), 283–87, and Robert R. Nathan, "Comments of Sumner H. Slichter," *ibid.*, pp. 288–91.

[15] Japan's experience with a capital levy in 1946–47 has made Japanese authorities skeptical regarding the efficacy of such a levy to halt inflation which is still in progress. The tax can be paid (if the taxpayer takes advantage of all legitimate delays in payment) in a currency cheaper than that in which it was assessed. Even when tax collections reach their estimated money total, the net anti-inflationary effect is apt to be less than anticipated. For a somewhat different view see Henry Shavell, "Postwar Taxation in Japan," *Journal of Political Economy*, LVI (April, 1948), 130–34, and "Taxation Reform in Occupied Japan," *National Tax Journal*, I (September, 1948), 131–34.

Japan's mid-inflation currency conversion in 1946 had disheartening results as well. At this time the government deficit was so great as to cancel within four months the effect on the monetary volume of a ten-to-one conversion rate. This expansion, moreover, had been forecast from the start in sagacious circles.

[16] It should be realized that Japanese Communist newspaper editorials, propaganda pamphlets, and the like are made more available to Americans in Japan than is any research on which they may be based.

pairing the deterioration in Japan's land and water resources, transportation and communication facilities, etc., which have been admittedly neglected for ten or fifteen years. Another is a drastic redistribution of both wealth and income, at the expense of "black-market profiteers" and "tax evaders" rather than capitalists as such. The Communists apparently feel that much of the *capital* of these people can be liquidated and made available as *income* to the proletarian recipients, thereby easing the cost of reconstruction for the masses more than one would imagine from the distribution of either wealth or income taken by itself. A third device is increased trade (on a bilateral barter basis) with areas now in the Soviet sphere, such as China, and other areas whose output of exportable goods for Japan would increase if fighting were to cease (by the establishment of Communist control), such as Burma, Indo-China, and Indonesia. Fourth, the simultaneous reduction of taxes and the price level[17] by the elimination of those government expenditures which protect "capitalists." (By this is meant, primarily, expenditures for the Japanese police force, as well as expenses on behalf of the Occupation. These latter comprise approximately 17 per cent of the General Account budget for 1950–51, under the heading "Termination of War Expenditures.") A fifth plank in the Communist platform is the immediate easing of population pressure within Japan by large-scale resettlement in Manchuria and Siberia. The Communists consider conditions in Manchuria and Siberia sufficiently attractive for such emigration to be voluntary. Most non-Communist Japanese disagree so violently that any immediate resettlement would probably require compulsion.

Communist economic planning itself, as is well known, promises to avoid both depression and open inflation entirely. It sees no evil in dictatorship, however, so long as it is of the proletarian variety, and therefore goes much further than the Socialist or ESB programs both in the extent of its economic regulations and in the rigor of their projected enforcement.

[17] The Japanese Communist party appears to hold the belief that *all* taxes are inflationary per se and that anti-inflation fiscal policy must take the form of reduced government expenditures.

THE RATE OF INTEREST AND THE MARGINAL PRODUCT OF CAPITAL

LLOYD A. METZLER
University of Chicago

I

THE doctrine of marginal productivity, in one form or another, is an essential feature of most modern theories of capital and interest. But in some of these theories the marginal product of capital enters only as a by-product of something else, while in others marginal product is the immediate determinant, or at least the direct measure, of the rate of interest. Whether the marginal product of capital is regarded as a direct measure of the rate of interest or is related only indirectly to this rate depends upon the concept of capital itself, and in this respect it is useful to divide capital theories into two broad groups. First, there are those theories which conceive of capital as a co-ordinate factor of production having exactly the same status in the theoretical framework as land and labor. Perhaps the outstanding example of this first type of capital theory is the Cobb-Douglas theory of production, in which total output is considered to be a function of the total supply of labor and the total quantity of capital.[1] J. B. Clark's theory of distribution also belongs in this first group, although the purely descriptive parts of his major work, as distinct from the theory itself, frequently contain a somewhat different concept of capital.[2] Second, there are those theories which conceive of capital as the value of a command over useful resources in general without attempting to make a sharp distinction between capital goods and other agents of production. Each of the agents of production, in this view, has a capital value equal either to the discounted value of its expected return or to its cost of production, the two different measures, in equilibrium, giving the same result. The prototype of the second group is Professor Knight's well-known theory of capital.[3] Ironically, the Austrian theory of capital,[4] which Professor Knight has consistently opposed, also belongs to this second group,

[1] C. W. Cobb and P. H. Douglas, "A Theory of Production," *American Economic Review*, XVIII (1928 Supplement), 139–65. For a summary of work subsequently done along these same lines see P. H. Douglas, "Are There Laws of Production?" *American Economic Review*, XXXVIII (1948), 1–41. See also the excellent bibliography in *Readings in the Theory of Income Distribution*, ed. W. Fellner and B. F. Haley (Philadelphia, 1946), pp. 671–77.

[2] J. B. Clark, *The Distribution of Wealth* (1899; reprinted, New York, 1931), chaps. xii–xx. "As we have said, the addition to the product caused by the last unit of capital fixes the rate of interest. Every unit of capital can secure for its owner what the last unit produces, and it can secure no more. The principle of final productivity, in short, acts in two ways, affording a theory of wages and of interest" (p. 187).

[3] Professor Knight has written so extensively on capital theory that it is difficult to select one or two articles as representative of his views. Perhaps the most representative are the following: F. H. Knight, "Interest," *Encyclopaedia of the Social Sciences*, ed. E. R. A. Seligman and A. Johnson (New York, 1932), VIII, 131–43; "The Quantity of Capital and the Rate of Interest," *Journal of Political Economy*, XLIV (August, 1936), 433–63, 612–42. See also the bibliography in *Readings in the Theory of Income Distribution*, pp. 696–97.

[4] E. von Böhm Bawerk, *The Positive Theory of Capital*, trans. William Smart (1891), Books V, VI, VII. Perhaps the best exposition of the Austrian theory of capital is to be found in K. Wicksell, *Lectures on Political Economy*, I (English ed.; New York, 1934), 144–80.

and so does the closely related theory of discounted marginal productivity.[5]

In the first group of theories, which envisage capital, labor, and land as co-ordinate factors of production, the marginal product of capital is considered to be a direct measure or determinant of the rate of interest, just as the marginal products of labor and land are direct measures or determinants of wage rates and rents, respectively. In the second group, on the other hand, there is no such immediate link between marginal products and the returns to the agents of production. Since capital, according to the second view, does not represent any specific agent of production analogous to land or labor, it is impossible to regard the income per unit of capital as the marginal product of any specific agent. To be sure, the return to capital, being dependent upon the income earned by specific agents of production, is closely related to the marginal products of these agents; but the relation between marginal product and return is not necessarily one of complete equality. In this broader view of capital, in other words, the marginal product of "capital in general," is not necessarily the same thing as the marginal product of a particular type of machine or of a particular type of land. Wicksell[6] long ago pointed out that, because of this discrepancy, the rate of interest may not be equal to the marginal social product of capital; and his arguments were subsequently repeated by Åkerman,[7] Lange,[8] and Stigler.[9]

Despite this repetition, however, there is still a considerable amount of confusion concerning the exact relation between marginal productivity and interest. There is a tendency, in particular, to conclude that the final results reached by the second group of capital theories—by the theories which regard capital as a command over resources—are substantially the same as the final results reached by the first group of theories. No matter what the initial capital concept may be, in other words, interest is frequently held to be equal, in a state of equilibrium, to the marginal product of capital. This is true even in such a distinguished work as Lerner's *Economics of Control*. After presenting what amounts essentially to a version of the Austrian theory of capital, Lerner later argues that, in the long run when the stock of capital is in equilibrium and the economic system has accordingly reached a stationary state, the rate of interest is equal to the marginal product of capital.[10] Using the Austrian theory of capital as a point of departure, Lerner thus reaches a final result identical with the result obtained from the Cobb-Douglas theory of production or from Clark's marginal productivity theory of interest and wages.

In citing this example from Lerner's major work, I do not mean to make an invidious comparison, for the same point of view can be found among many other economists. Indeed, it sometimes seems as though a marginal productivity schedule, relating the quantity of capital to its marginal product, has at one time or another been derived from almost every

[5] Wicksell, *op. cit.*, pp. 181–82; W. W. Leontief, "Interest on Capital and Distribution: A Problem in the Theory of Marginal Productivity," *Quarterly Journal of Economics*, XLIX (1934–35), 147–61.

[6] Knut Wicksell, *Über Wert, Kapital, und Rente* (Jena, 1893), pp. 111–16. See also Wicksell's *Lectures*, I, 180.

[7] Gustav Åkerman, *Realkapital und Kapitalzins* (Stockholm, 1923), pp. 95–96.

[8] Oskar Lange, "The Place of Interest in the Theory of Production," *Review of Economic Studies*, III (1935–36), 185.

[9] G. J. Stigler, *Production and Distribution Theories* (New York, 1941), pp. 288–89.

[10] A. P. Lerner, *The Economics of Control* (New York, 1944), chap. xxv.

conceivable concept of capital. And, as a corollary, the interest rate has then been ascribed to the marginal product of capital. Now, for many practical purposes, including those which Lerner had in mind, there is probably no great harm in this procedure, since the rate of interest *is* closely related to the marginal product of capital. Nevertheless, the procedure is not entirely correct; and, in view of the widespread misunderstanding on this point, it seems useful to present a more rigorous account of the relation between the rate of interest and the marginal product of capital.

It will be shown below that, if capital is regarded as a command over useful resources, or as the investment value of a process of production, the rate of interest is never, except by accident, equal to the marginal social product of such capital. The reasons for this discrepancy will be discussed in some detail. Although the argument below repeats, in part, the earlier observations of Wicksell, I believe that such repetition is justified by the fact that Wicksell failed to make an impression upon later economists.

II

It is not always easy, at first glance, to see how a permanent discrepancy between the interest rate and the marginal product of capital can exist in a perfectly competitive market without calling into play some counteracting forces. Consider, for example, the economic decisions of an individual businessman. Suppose that this particular businessman produces a commodity that requires the use of a certain type of machine. If the capital market is competitive, the businessman will be faced with a given interest rate at which he can borrow or lend, and he will accordingly adjust his production plans so as to maximize the present value of his expected future income at this given interest rate. Among other things, this means employing such a number of machines that the marginal net product of each machine, expressed as a ratio of the price of the machine, is equal to the interest rate. In other words, the businessman will purchase and use additional machines up to the point where the marginal income derived from each machine, after making necessary expenditures for maintenance, is equal to the amount of interest that would have to be paid, at the prevailing rate, on the private capital invested in each machine.

Now, this is surely the same as saying that, for an individual firm and for a particular type of capital good, the marginal product of capital is equal to the interest rate; and, if such a proposition is true for one firm and one agent of production, why is it not also true for all firms and all agents of production taken together? In other words, if the interest rate is equal to the marginal private product of capital, why is it not also equal to the marginal *social* product of capital? The answer to this question is to be found, as might be expected, in a discrepancy between *private* and *social* products of capital. But the difference between the private and the social products is not of the type customarily considered in economic theory, for it has nothing to do either with the usual type of external economies and diseconomies or with imperfect competition. Even if all product and factor markets were perfectly competitive, and if there were no external economies or diseconomies of production, it might still be true that the marginal private product of capital would differ from the marginal social product and that, as a consequence, the rate of interest would not be equal to the marginal social product of capital.

The divergence of the social from the private product of capital is attributable to the fact that it is impossible to find an invariant unit in which to measure the social quantity of capital. To put the matter another way, we may say that a change in the supply of capital, arising, for example, from new voluntary saving, alters the units in which all the previously existing capital is measured; and it is therefore incorrect to say that the supply of capital as a whole has increased by the amount of the voluntary saving. It is important to emphasize that this problem of measuring the quantity of capital is not an index-number problem. There are, to be sure, numerous index-number problems of the greatest complexity in the theory of capital. But the problem to which I now refer would exist even in the simplest economy in which all output consisted of a single type of consumers' goods and all firms were exactly alike.

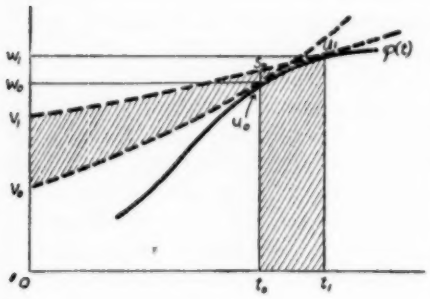

FIG. 1

The argument is perhaps most easily illustrated by an extremely simple version of the Austrian theory of capital. As will be shown later, however, the conclusions reached are valid for more general concepts of capital as well. Consider an economy in which all output consists of one commodity, timber, and suppose that the only costs of producing the timber are the labor costs of preparing the ground and planting the seedlings and the interest charges on invested capital. The costs of felling the trees, in other words, are assumed to be negligible, relative to initial expenditures for planting.[11] This is the point-input, point-output version of the Austrian theory. The total output of timber obviously depends not only upon the number of workers employed in planting but also upon the period of time that the trees are allowed to grow.

Let the output *per worker* be represented in Figure 1 by the line $w = \phi(t)$. This line expresses the amount of timber that can be produced per year by each worker as a function of the length of time the trees are permitted to grow. If the age of the trees at the time of cutting is t_0, for example, output per worker will be w_0, while if the age is t_1, output will be w_1.

The length of time that the trees are permitted to grow will obviously depend upon the amount of capital that businessmen are willing and able to invest in their enterprises; that is, it will depend upon the economy's accumulated stock of wealth, expressed in units of income.[11a] If a particular businessman wishes to produce an annual output per worker of w_0, for example, he will have to let his trees attain an age of t_0 before cutting. Suppose that t_0 is thirty-five years. In

[11] I am well aware that these assumptions do not correspond at all to actual forestry practice. The simplified model of timber production is introduced simply because it brings out most clearly the relation between the rate of interest and the marginal product of capital. More realistic and more complicated models would in no way alter this fundamental relation.

[11a] Alternatively, we might say that the period of production is governed by the supply and demand for capital. The supply of capital, in turn, is determined by the preferences of income earners for holding assets or consuming their wealth, which means that time preference or abstinence, or both, are ultimately determinants of the period of production.

order to produce an annual output of w_0 per worker, the businessman will then have to have thirty-five wood-lots with a uniform age distribution of trees varying between one and thirty-five years. In this way one of his wood-lots will be ready for cutting and replanting each year.

Let v_0 in Figure 1 be the wage rate per worker per year. The capital per worker that the businessman has invested in his one-year-old trees will then be the wage rate, v_0, plus interest at the market rate for one year. Likewise, the capital per worker invested in the two-year-old trees will be v_0 plus interest *compounded* for two years, and so on for the older trees. Now, if the dotted line v_0u_0 represents the compound-interest line at the prevailing interest rate, it is clear that the amount of capital invested in trees of any particular age will be the distance of this line from the abscissa at the point representing the particular age of the trees. And if the wood-lots have a uniform age distribution between unity and t_0, the total capital per worker required for an annual output of w_0 will be the sum of all such distances, which is the same as the area $ov_0u_0t_0$.

Suppose that the accumulated wealth per worker that the community as a whole is willing to hold is exactly equal to this area, and let ρ_0 be the interest rate at which the compound-interest line v_0u_0 is computed. The output per worker, w_0, the age of the trees at cutting, t_0, the wage rate v_0, and the interest rate ρ_0, will then be in equilibrium in at least three different respects. First, for the given values of wages, interest, and the period of production, the amount of capital per worker is equal to the community's propensity to hold wealth, so that there is no tendency toward saving or dissaving and, accordingly, no changes in methods of production. Second, since the accumulated value of wages, compounded for t_0 years, is equal to w_0, the businessmen are earning neither profits nor losses, and there is accordingly no incentive for a change in the number of firms. In other words, the amount of timber per worker felled at age t_0 is equal to the cost of planting these trees plus interest accumulated for t_0 years. In the discounted productivity doctrine, this second proposition is stated the other way round, by saying that the discounted value of the final product is equal to the wage rate. But, whatever way it is stated, it means that the final product is equal to its cost of production, including the interest cost. Third, since the compound-interest line or the discount line, v_0u_0, is tangent to the production function at u_0, there is no other period of production which would be as profitable to the businessmen as the period t_0. At the prevailing interest rate, in other words, the discounted value of final output is maximized at t_0. Thus, in brief, the output, w_0, is an equilibrium output in the sense that at this output the supply of capital per worker is equal to the demand, the revenue from the product is equal to the cost of production, and profits are being maximized.

Suppose, now, that this equilibrium is disturbed by an increase in capital arising from voluntary saving. According to the Austrian theory, the increase in capital leads to a sequence of events somewhat as follows: The interest rate falls, as the prices of securities are bid up by the new savers, and the discounted value of the output w_0 rises above v_0. Or, to put the matter in another way, the cost of production declines as a consequence of the lower interest rate, and businessmen earn excess profits. The excess profits attract new firms, whose competition for

labor forces up the wage rate. Finally, at the new, lower interest rate the period of production, t_0, is no longer the most profitable; it is now profitable to permit the trees to grow longer and consequently to employ more capital per worker.

In Figure 1, I assume that the increase in capital eventually results in a new equilibrium at which the period of production is t_1, output per worker is w_1, wages are v_1, and the quantity of capital per worker is $ov_1u_1t_1$. The new interest rate, ρ_1, is not shown directly in the figure, but it governs the slope of the compound-interest line v_1u_1; in particular, the *relative* slope of the line at any point is equal to ρ_1.

We wish to see, now, how the interest rate, ρ_1, is related to the marginal product of capital. The marginal product of capital, in absolute terms, is simply the difference between output w_1 and output w_0. The marginal product per unit of capital, on the other hand, is this amount $(w_1 - w_0)$ divided by the increase in the quantity of capital. The quantity of capital per worker has increased from $ov_0u_0t_0$ to $ov_1u_1t_1$, and this increase can be divided into two parts. The first part is the area, $v_0v_1s_0u_0$, which represents the excess of investment cost under the new wage and interest rates over investment cost under the old wage and interest rates of a process of production having a period t_0. In other words, if businessmen in the new situation attempted to set up a production process with length t_0, their total investment per worker, including interest, would be $ov_1s_1t_0$, whereas the actual amount invested in such a process, in the previous equilibrium, was only $ov_0u_0t_0$. The difference between the two amounts is the shaded area, and this of course represents the *capital gains* per worker from all goods-in-process existing at the time the capital supply was increased.

The other part of the capital increase, shown in Figure 1 by the second shaded area, $t_0s_0u_1t_1$, consists of the new voluntary savings. Although these voluntary savings were the initiating force which brought about a change in the period of production from t_0 to t_1, it is obvious from the figure that the total increase in capital is larger than the voluntary savings themselves. Moreover, the capital gains, which account for the excess of the total increase in capital over the new voluntary savings, are as much a part of real capital as are the voluntary savings. Under the new economic conditions, the investment cost, including interest, of a process of production having the new period t_1, is equal to $ov_1u_1t_1$; and it is this investment cost, rather than the actual amounts spent on earlier investments, which explains the value of both old and new investments in the new equilibrium.

It is apparent from Figure 1 that the increase in product expressed as a percentage of the increase in total capital, or, more briefly, the marginal product of capital, is equal to the distance $w_1 - w_0$ divided by the sum of the two shaded areas of the figure. We wish to compare this ratio with the rate of interest. The rate of interest, as noted earlier, is equal to the *relative* slope of the compound-interest line, and in equilibrium this line is tangent to the production function $\phi(t)$. The relative slope of the production function is $(\Delta w/\Delta t) \cdot (1/w)$, where both Δw and Δt are assumed to be small; and it follows that, in equilibrium, $\rho_1 = (\Delta w/\Delta t) \cdot (1/w)$. Now, if the new voluntary savings are small, Δw may be taken to be equal to $w_1 - w_0$, while $\Delta t \cdot w$ will differ only by an infinitesimal amount from the shaded area $t_0s_0u_1t_1$. Since the latter is the geometrical representation of the new voluntary saving, we may say that the rate of interest is equal to the increase in product divided by the

new voluntary saving. The marginal product of capital, on the other hand, is equal to the increase in product divided by the *total* increase in capital, And, since the increase in capital includes capital gains as well as new saving, it is clear that the denominator of the ratio representing the marginal product of capital is larger than the denominator of the ratio representing the rate of interest. It follows that, for the type of investment process represented by Figure 1, the rate of interest is always larger than the marginal product of capital.

The increase in capital in the preceding illustration has been divided into two parts, a voluntary increase consisting of new savings and an involuntary increase consisting of capital gains. These two parts might equally well be called, respectively, a primary increase and a secondary increase in capital; and, as long as the distinction between the two remains valid, the rate of interest may be regarded as the marginal product of voluntary savings, or as the marginal product of the primary increase in capital, a quantity which is distinct from, and greater than, the marginal product of the increase in capital as a whole. In the Austrian theory of capital, however, the total quantity of capital is considered to be a result of deliberate decisions of income-earners as to how much accumulated wealth they wish to hold. No place can be found in this theory for changes in the quantity of capital arising from such fortuitous events as capital gains and losses. Unless accompanied by a deliberate or voluntary increase in the desire to hold wealth, capital gains, in the Austrian view, would lead to consumption of part of accumulated wealth, while capital losses would stimulate further saving to make up such losses. Thus, in comparing one position of equilibrium with another, as in Figure 1, the entire increase in capital between the one position and the other must be considered, according to the Austrian theory, to be voluntary savings. In this event, the rate of interest obviously cannot be described as the marginal product of voluntary savings, for such savings constitute the entire increase in capital. The new savings are used for two quite distinct purposes, however, and it is only one of these which affects the level of output and hence the rate of interest. In part, the new savings must be used to buy some of the assets of previous owners who are assumed to consume their capital gains. The remaining part can then be used to lengthen the period of production, or, more generally, to produce additional capital goods; and it is this part which governs the rate of interest. But whether the entire increase in capital is deliberate, or whether part of it is accidental as in the earlier illustration, it remains true that the rate of interest is higher than the ratio of the increase in product to the increase in total capital. In short, the interest rate exceeds the marginal social product of capital.

III

Although the foregoing argument has been developed exclusively from the point of view of the Austrian theory of capital, it is equally applicable, as I have indicated earlier, to other capital concepts. Consider, for example, Professor Knight's theory of capital. Capital, according to this view, is an accumulated stock of purchasing power or command-over-resources, whose value, expressed in units of income, is equal both to the discounted value of the annual income earned by these resources and to the cost of producing the resources, with interest compounded at the market rate. For our purposes it is the second of these measures of capital that is the more impor-

tant. If the value of a machine or other capital good is taken to be its potential cost of production under existing conditions, it follows, as in the Austrian theory, that no invariant unit can be found in which the capital value of agents of production can be measured. A 10 per cent increase in capital, for example, will not normally be associated with an increase of exactly the same relative amount in machines or other capital goods, since the increase in machines will itself alter the units in which capital is measured. The proper measure of capital in Knight's theory is the value of the goods foregone or the value of the potential income which would have to be sacrificed in bringing such capital into existence, and this potential income depends not only on the physical quantity of resources employed in producing capital goods but also upon the efficiency of these resources in the alternative employment of producing current income. Now, an increase in capital increases the productivity of the economic system as a whole, and thereby alters the returns, expressed in current income, to the agents of production. An increase that took the form of additional machinery, for example, would increase the marginal productivity of labor and thereby lead to an increase in wages. The higher wage rate would mean that the employment of a given number of workers to produce machines rather than to produce for immediate consumption would involve a larger sacrifice of current income than was necessary before the increase in capital occurred. In so far as labor cost is concerned, in other words, the accumulation of capital in the form of machines increases the cost of production of such machines and leads to capital gains. And, as in the Austrian theory, the capital gains tend to keep the marginal social product of capital below the rate of interest.

Here, however, we are confronted with several complicating factors. The most important of these complications arises from the fact that machines are produced not only by the employment of labor but also by the employment of other agents of production, including machines themselves. Metalworking machines, for instance, are required to produce metalworking machines, trucks to produce trucks, and so on almost without limit. In the Austrian theory of capital, this complication was ignored, and the assumption was made, either explicitly or implicitly, that the investment cost of a particular process of production could be traced back to a combination of the so-called "original" factors of production, labor and land, plus accumulated compound interest. It was accordingly not difficult to show, as in Figure 1 above, that an increase in wealth would bring about capital gains and that the return to capital as a whole would consequently exceed its marginal product. Higher wages and higher rents arising from an increase in capital are the direct cause, according to the Austrian theory, of an increase in the investment cost or replacement cost of every process of production and accordingly of capital gains for goods already in process. Moreover, the increased replacement costs and associated capital gains occur even though the rate of interest, which also enters into the cost of investment, tends to decline when the amount of capital is increased; the decline in interest cost does not completely offset the rise in wages and rents.

When we come to examine more complicated and more realistic situations in which machines as well as labor and land co-operate in the production of more

machines, it is by no means certain that an increase in capital will bring about capital gains in the manner envisaged by the Austrian theory. For, while wages and rents will probably rise as a result of the larger supply of capital, it is not clear that the price of machines will also rise. Indeed, since the increase in capital will normally raise the ratio of machines to other agents of production, there is a presumption that the marginal product of machines will decline, and the price of machines will therefore have to fall. In this event, the investment outlays required to produce a particular type of machine may well fall, rather than rise, when the amount of capital is augmented. In other words, if machines are used to produce machines, the decline in the price of such machines may more than offset the rise in wages and rents, with the result that the investment cost of a particular process is reduced. If this happens, an increase in capital will lead to capital losses rather than capital gains, and by the same sort of reasoning as above it follows that the rate of interest will fall short of the marginal social product of capital. As before, the rate of interest will equal the marginal return to new voluntary savings, but the increase in voluntary savings will now *exceed* the increase in capital as a whole.

It is apparent from the case just considered that the relation between marginal product and the rate of interest is exceedingly complex. A general increase in social capital may bring about either capital gains or capital losses, and the marginal product of social capital may accordingly exceed or fall short of the rate of interest. Whether the one or the other of these possibilities will occur depends upon a complicated set of economic and technical relations that almost defies description or generalization. The outcome depends, to a considerable extent, upon the ease or difficulty of substituting machines for labor in the various branches of production, and upon the ratios of high-capital agents of production to low-capital agents in different stages of production. For present purposes, however, it is sufficient to emphasize that an increase in capital alters the cost, in terms of foregone income, of producing various agents of production and that, as a consequence, the units in which capital is measured are also altered. The resulting capital gains or losses may conceivably more or less offset each other, so that the marginal social product of capital as a whole is not markedly different from the rate of interest. On the other hand, capital losses may predominate over capital gains, or conversely. But, in any event, it is clear that there is no assurance that the interest rate will necessarily equal the marginal social product of capital.

IV

I have argued above that whether an increase in social capital leads to capital losses or to capital gains depends to a large extent upon the ease of substituting machines for labor. Since this process of substitution is not readily depicted in the Austrian theory of capital, the latter is capable of explaining only part of the relation between the rate of interest and the marginal social product of capital. Nevertheless, a slight modification of the Austrian theory can be found which shows, in a reasonably clear manner, how the rate of interest can sometimes be *below* the marginal product of capital. Suppose, as in our earlier discussion of the Austrian theory, that all capital consists of investment of labor in wood-lots and that the only labor outlay in this process is that which occurs at the time the trees

are planted. In the present example, however, in place of the previous assumption that the national income consists exclusively of the output of lumber, I shall suppose that lumber is merely an intermediate product employed in the production of a final commodity, X. Both labor and lumber are assumed to be employed in the production of the final product. In order to avoid complications arising from

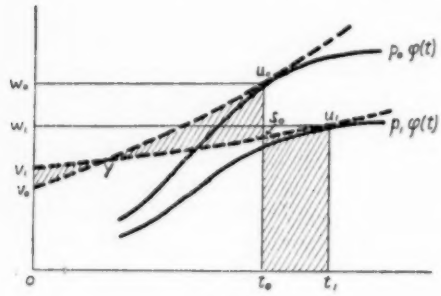

FIG. 2

investment in the final stage of production, I assume that the time required to produce X is so short, relative to the growth period of the trees, that the capital investment in the final stage is negligible. As in our earlier example, social capital will then consist exclusively of the investment in growing trees.

Let the production function for lumber, expressing the output per worker as a function of the age of the trees when felled, be represented, as before, by the function $\phi(t)$. Since lumber in the present example is only an intermediate product, and since both the quantity of capital and the wage rate must ultimately be measured in terms of the final product, X, it is appropriate to express the production of lumber not in units of lumber but in the equivalent units of X. This means that the function $\phi(t)$ must be multiplied by the price of lumber in terms of X. Suppose that in the initial equilibrium a unit of lumber exchanges for p_0 units of X. The production function for lumber, expressed in units of the income-commodity X, will then be represented by $p_0\phi(t)$, as in Figure 2. The initial position of equilibrium depicted by Figure 2 is such that the optimum period of growth for the trees is t_0, the wage rate is v_0, the value of lumber output per worker in units of final income is w_0, the amount of capital per worker in the lumber industry is the area $ov_0u_0t_0$, and the rate of interest is the relative slope of the compound-interest line v_0yu_0.

Suppose, now, that this equilibrium is disturbed by new savings. As in the earlier example, the new savings force down the rate of interest, entrepreneurs earn excess profits, and competition eventually eliminates these profits by forcing up wages. At the same time, the lower rate of interest makes it profitable for the entrepreneurs to extend the growth period of the trees; and lumber output per worker, in physical units, accordingly rises. Moreover, in the present example there is an additional equilibrating force at work: excess profits are eliminated not only by a rise in wages but also by a fall in the price of lumber in terms of the final product, X. Lumber is used exclusively in the production of this final product, and the price of lumber is governed by its marginal productivity in this employment. It is therefore clear that, as the supply of lumber increases, both its marginal product and its price, in terms of X, must decline. Let the new lower price be p_1. In Figure 2 the decline in the price of lumber is shown by the downward shift of the "value product" curve, $p_1\phi(t)$. This downward shift is a uniform relative shift throughout the length of the production function, the extent of the

shift being equal to the relative decline in price.

When equilibrium is re-established after the increase in the supply of capital, the period of production has been increased from t_0 to t_1, the wage rate has risen from v_0 to v_1, the price of lumber has declined from p_0 to p_1, the interest rate has fallen, and the amount of capital per worker has been increased to the area $ov_1u_1t_1$. Figure 2 has been so constructed that the *total value* of lumber output per worker is smaller in the new equilibrium than in the old, but this is by no means a necessary consequence of the increase in capital; whether the value of lumber output per worker rises or falls obviously depends largely upon the degree of the decline in the lumber price, and this in turn depends upon the difficulty or ease of substituting lumber for labor in the production of the final product, X.

In any event, our primary concern is not with the movements of all the variables of the system but rather with the relation between the marginal social product of capital and the rate of interest; and this relation can be described, in part at least, in terms of capital gains and capital losses as in the earlier illustration. Since equilibrium in the market for the capital good, lumber, was re-established partly by a fall in the lumber price and only partly by a rise in wages, it is evident from Figure 2 that the rise in wages is not in itself sufficient to guarantee capital gains to the owners of the growing trees. Thus in Figure 2 the cost, at the new wage and interest rates, of investing in the old process of production with length t_0 is $ov_1s_0t_0$, and, under the conditions assumed in the figure, this reproduction cost of the old investments is *smaller* than the former value of these investments; that is, the area of $ov_1s_0t_0$ is smaller than the area of $ov_0u_0t_0$. An increase in capital, under the conditions assumed in Figure 2, thus leads to capital losses. To this extent the increase in capital as a whole tends to be smaller than the new voluntary savings, and by an argument converse to the one presented earlier the marginal social product of capital tends to *exceed* the rate of interest.[13]

As in the earlier example, the rate of interest is equal to the value of the marginal product of the capital that is employed to extend the period of production; in the terminology of the Austrian theory, it is the marginal product of time. Unlike the earlier illustration, however, the amount of capital so used in the present example may be larger, because of capital losses, than the increase in capital as a whole. Moreover, the present example differs from the simple model given in Figure 1 in still another respect: in the simple point-input, point-output

[13] The economic system depicted in Figure 2 resembles, in some respects, the model developed by Åkerman (*op. cit., passim*). Although Åkerman seemed to feel that his contribution to capital theory consisted in his analysis of *durable* capital goods, the feature of his approach which really distinguished it from the earlier work of Böhm Bawerk and Wicksell was the fact that his model envisaged competition and substitution between capital *goods* and labor in the final stages of production of consumers' goods. In contrast to Åkerman's system, the simplified period-of-production system of Böhm Bawerk and Wicksell allowed only for substitution between time (capital in general) and labor in the process of production as a whole. The basic difference, then, between Wicksell and Åkerman is the same as the difference between Figure 1 and Figure 2 of this paper. Since he had considered only models similar to Figure 1, Wicksell failed to understand how capital accumulation could lead to capital losses for the society as a whole, as in Figure 2. In commenting on Åkerman's problem, Wicksell said, "I cannot enter now on the explanation of this very puzzling formula; presumably it belongs to the sphere of dynamic theory, where we cannot confine ourselves to the comparison of two different equilibria, but must also study the transition from one to the other" (*Lectures*, I, 293). This explanation is wrong, of course, but I believe that it reveals the true difference between Wicksell's capital theory and Åkerman's.

model of Figure 1, the capital employed in extending the period of production was identified with primary new saving, but in the more complex situation of Figure 2 this identification is no longer possible. In Figure 1 the entire labor force was assumed to be employed in capitalistic production—planting trees—and the proportionate increase in capital per worker was therefore the same as the proportionate increase in capital as a whole. In Figure 2, on the other hand, only part of the labor force is employed in the production of lumber, the remainder being employed directly in the production of the income-commodity, X. Figure 2 is drawn in terms of output and capital per worker in the lumber industry, and, since workers can shift back and forth from this industry to the X industry, capital per worker in the lumber industry can change not only because of an increase in the amount of capital available but also because of an increase or decrease in the number of workers in that industry. Thus, if the number of workers in the lumber industry declines, the amount of capital per worker employed in lengthening the period of production will exceed the amount of primary new savings. The excess, of course, represents capital that is freed when some of the wood-lots are cut over and abandoned. Conversely, if the number of workers employed in the production of lumber *increases*, the capital available for extending the period of production will fall short of the new primary savings; in this event, part of the new savings will have to be used in planting new wood-lots in order to employ the additional labor force.

Whether employment of labor in the lumber industry rises or falls when the amount of capital is increased depends upon a complex set of circumstances, particularly upon the character of the production function in the X industry. In the present problem, however, there is no need to analyze in detail the movements of the labor force between the lumber industry and the X industry. The point I wish to emphasize is that the rate of interest may *conceivably* fall short of the marginal social product of capital, and this point can be demonstrated by considering an intermediate situation in which the number of workers in the lumber industry is unaffected by the increased supply of capital. If the number of workers employed in producing lumber remains unchanged, the relative increase in the amount of capital available per worker will be the same as the relative increase in capital as a whole; Figure 2, which is drawn in terms of output and capital per worker, can therefore be used to describe the movements in the total supply of capital and in the total value of lumber output.

As before, the marginal social product of capital and the rate of interest are equal, respectively, to the following ratios:

$$\text{Marginal product of capital} = \frac{\text{Value of increase in lumber output}}{\text{Increase in capital}}$$

$$\text{Rate of interest} = \frac{\text{Value of increase in lumber output}}{\text{Capital used in extending period of production}}.$$

The numerators of these expressions are the same, and the marginal social product of capital can therefore differ from the rate of interest only on account of differences in the denominators. Under the conditions assumed in Figure 2, the first denominator is obviously smaller than the second; that is, the increase in capital as a whole is smaller than the amount of capital employed in extending

the period of production. The increase in capital per worker, in Figure 2, is equal to the area $t_0s_0u_1t_1$ *plus* v_1yv_0 *minus* u_0ys. The figure has been drawn in such a way that u_0ys_0 exceeds v_1yv_0, and it follows that the increase in capital per worker is *less* than $t_0s_0u_1t_1$. But $t_0s_0u_1t_1$ represents the amount of capital per worker employed in lengthening the period of production, and it is this quantity, rather than the increase in capital per worker, which is related to the rate of interest. Under the conditions assumed in Figure 2, then, the rate of interest is less than the marginal social product of capital.

V

We have seen in the preceding discussion that the rate of interest may either exceed or fall short of the marginal social product of capital. This means that those capital theories which regard capital as a co-ordinate factor of production having the same status as the so-called "non-capital" factors, labor and land, are subject to a persistent bias in one direction or the other. Except by accident, the rate of interest cannot be described as the marginal product of capital in the sense that wages, in a noncapitalistic process of production, are the marginal product of labor. It is true, to be sure, that in a stationary state in which the demand for capital is equal to the supply, the rate of interest will equal the marginal *private* product of capital; for, if this were not the case, the entrepreneurs would always have an incentive to expand or contract their employment of capital. But the nature of capital is such, as we have seen, that its marginal private product is never, except accidentally, equal to its marginal social product.

It is perhaps worth repeating that the discrepancy between the private and the social products is not attributable to monopoly. Nor is it attributable to complications arising from aggregating heterogeneous magnitudes into a social composite. Even in the simplest economy imaginable, in which production was limited to one final product and the process of production was exactly the same for all firms, it would still be true that the marginal private product of capital, and hence the rate of interest, would differ from the marginal social product.

The fundamental reason for the discrepancy is that the units in which social capital is measured—i.e., the potential income that would have to be foregone in producing the agents of production—have no invariant counterpart in the physical quantity of capital goods. In other words, a 10 per cent increase in social capital need not mean a 10 per cent increase in machines, even if all capital is devoted exclusively to the production of such machines; the relative increase in the number of machines may be either greater or less than 10 per cent, depending upon whether the increase in capital leads to capital losses or to capital gains. The rate of interest is equal to the marginal product of the new machines, expressed as a percentage of the value of the new machines, whereas the marginal social product of capital is equal to the same marginal product of the new machines divided by the increase in value of all machines taken together. Since an increase in capital alters the value of machines already in existence, the total increase in capital is not necessarily the same as the value of the new machines.

Attempts have been made in two different ways, as my colleague Professor Friedman once pointed out to me, to avoid the difficulty regarding the units of capital. First, Böhm Bawerk and those who followed his lead proposed the average period of production as a measure of

the quantity of social capital, and the interest rate was then described as the marginal product of increasing this period of production. The ambiguities, both conceptual and statistical, involved in the concept of a period of production have been discussed so frequently that it is unnecessary for me to elaborate upon them here. It is sufficient to say that the period of production has not been widely adopted, even among the proponents of the Austrian theory of capital, as a practical or satisfactory measure of the quantity of capital.[13]

The second approach is to give up all attempts to measure capital in value units and to describe a country's capital endowment in terms of its physical units of machinery, equipment, and other capital goods. With this concept of capital, the return to a given type of capital good is a rental, the amount of which is equal to the marginal product of such equipment, just as the rent of land is equal to the marginal product of land. Although this procedure obviously avoids the difficulties of measuring capital, it is really no theory of capital at all, for it fails, on the one hand, to explain the rate of interest as a *ratio* of returns to value and, on the other hand, it provides no explanation of the tendency toward equality of interest rates among different types of investment.[14] Perhaps even more important, such an approach gives no clue as to how the supply of capital goods as a whole is related to the willingness of income-earners to hold assets.

Value is thus the essence of the capital concept, and we are thrown back, perforce, upon some unit of value as the unit of measure of the quantity of capital. But, having accepted this proposition, it is important at the same time to recognize that a one-to-one correspondence is not to be expected between changes in the quantity of capital, in the value sense, and corresponding changes in the quantity of the agents of production in which the capital is embodied. Discrepancies of this sort between the value measure and the physical measure of capital explain why the marginal productivity theory cannot be used, without modification, to describe the rate of interest.

VI

Assuming, then, that the marginal social product of capital differs from the rate of interest, we may inquire, in concluding this paper, into the social consequences of this difference. One of the cardinal tenets of welfare economics is that an economic system cannot be in an optimal position unless the marginal return to each factor of production is equal to that factor's marginal social product; if the wages of a particular type of labor differ from marginal social product, for example, social welfare can usually be increased by a change in the amount of such labor performed.[15]

Although capital is not a factor of production in the ordinary sense, it is nevertheless useful to ask whether a similar proposition is true of the rate of interest; that is, if the rate of interest differs from the marginal social product of capital, does the "quantity" of services per-

[13] Wicksell, for example, developed a capital theory which was essentially the same as Böhm Bawerk's and yet he measured the total quantity of capital either as the discounted value of its expected return or as the cost of production of the agents in which the capital was embodied. See his *Lectures*, *loc. cit.*

[14] In the terminology of Alfred Marshall, we might say that the physical concept of capital is capable of explaining the quasi-rents of various capital goods but not the rate of return on investment in such goods (see his *Principles of Economics* [8th ed.; London, 1930], p. 421).

[15] Lerner, *op. cit.*, pp. 102–5.

formed by capital tend, also, to differ from the social optimum? The answer to this question depends, in part, upon whether one is considering a stationary state or a growing economy. In a stationary state there is no doubt that a discrepancy between the rate of interest and the marginal social product of capital signifies a loss of economic welfare. It seems probable to me that this is also true in a growing economy. But in an expanding economic system there are a number of complications arising from uncertainty and from the unpredictable behavior of asset-holders, and these complications considerably reduce the force of our welfare proposition, as applied to capital, if they do not destroy it entirely. It will accordingly be convenient to begin with the simple if highly abstract case of the stationary state.

A stationary economy is characterized by the fact that the total wealth of the economy is equal to the amount which all its residents are willing to hold as a store of value. On balance, the residents consume all their current incomes, and no additional capital accumulation takes place. Now, from the point of view of an individual income-earner, an act of personal saving is equivalent to a reduction in present consumption and an increase, in perpetuity, of future income; and the rate at which income in perpetuity can thus be substituted for present consumption is equal to the rate of interest. If the rate of interest is 5 per cent, for example, new savings of $100.00 can be regarded as the substitution of an income of $5.00 per year in perpetuity for $100.00 of current consumption. In deciding whether to save or to dissave, an individual income earner will presumably alter his asset holdings until the marginal satisfaction derived from $100.00 of current income is equal, for him, to the marginal satisfaction of $5.00 per year in perpetuity. More generally, if r is the rate of interest, we may say that r is also the marginal rate of substitution, for the typical income-earner, between future consumption and present consumption. I shall call this the private rate of substitution.

If the stationary economy is to be in an optimal position so far as the total quantity of capital is concerned, this private rate of substitution must be equal to the rate at which the economy as a whole can substitute future income in perpetuity for present income; that is, the private rate of substitution must equal the social rate. But the social rate of substitution is the marginal product of capital. Thus, if the rate of interest differs from the marginal product of capital, the private rate of substitution between future and present consumption will necessarily differ from the social rate of substitution, and the quantity of capital will accordingly differ from the optimum. Suppose, for example, that the rate of interest is 5 per cent, while the marginal product of capital is 7 per cent. In this event an increase of social capital equal to $100.00 will enable the economy to produce additional income of $7.00 per year in future years. Asset holdings by individuals, however, have presumably stopped at the point where $100.00 of additional assets yield a private return of only $5.00 per year. It follows that both society as a whole and the individual asset-holders can gain by any arrangement whereby the asset-holders are given a *marginal* return for additional savings equal to something between 5 and 7 per cent. Such an arrangement obviously increases the welfare of the individual asset-holder, since the marginal rate at which he can substitute future income for present consumption exceeds

his private rate of substitution. And the economy as a whole also benefits, since the marginal social product of the additional capital is larger than the return to the individual saver. To put the matter another way, any additional capital obtained by the means suggested yields a social return in excess of the amount needed to compensate the new savers. This surplus return constitutes a sort of social dividend which may be used to increase the welfare of the community as a whole.[16]

From the foregoing, it should be evident that, when the marginal product of capital exceeds the rate of interest, the quantity of capital in a stationary state falls short of the social optimum. By similar reasoning the converse of this proposition can easily be demonstrated; that is, it can be shown that, when the marginal product of capital is *less* than the rate of interest, the quantity of capital, under stationary conditions, is *greater* than the optimal quantity. If the rate of interest is 6 per cent, for example, while the marginal product of capital is 5 per cent, an arrangement can be made whereby both the asset-holders and the rest of the society benefit from a reduction in the quantity of capital. The nonasset-holders benefit because the interest payments made to asset-holders on marginal assets exceed the social product of these assets. And the asset-holders gain because the private rate of substitution between current consumption and future consumption can be made more favorable to present consumption without eliminating completely the gain to the nonasset-holders.

Combining the results of the preceding paragraphs, we may formulate the general proposition that the quantity of capital in a stationary state tends to exceed or fall short of the social optimum according as the rate of interest exceeds or falls short of the marginal product of capital. Stated in this way, the proposition bears a striking resemblance to the theory of external economies and diseconomies within an individual industry. It has been argued by Pigou and others, for example, that in an industry where the firms are subject to external diseconomies, the marginal social cost of the industry's output exceeds the marginal private cost, and output therefore exceeds the socially desirable level; and, conversely, when there are external economies output tends to be too small.[17] The similarity between these well-known principles of welfare economics and the proposition I have presented concerning capital suggests that something akin to external economies and diseconomies may be present in the process of capital accumulation. And this is indeed true. To illustrate the point, suppose that the marginal product of capital is less than the rate of interest. In this case the marginal social product of capital is less than the marginal private product, and this suggests, by analogy, that capital ac-

[16] It will no doubt be apparent to the reader that the concept of an optimal amount of capital that I have employed is not a highly sophisticated concept. A given change is regarded as an improvement of welfare if the Hicks-Kaldor condition is satisfied; that is, the new position is preferable to the old if those who suffered a loss in going from the old position to the new can be compensated by those who benefited and if a surplus remains after making such compensation (*see* N. Kaldor, "Welfare Propositions in Economics," *Economic Journal*, XXIX [1939], 549–52; J. R. Hicks, "Foundations of Welfare Economics," *Economic Journal*, XXIX [1939], 696–712). I doubt whether the broader types of welfare comparisons, such as those proposed by Scitovszky and Samuelson, would lead to definite conclusions in the present instance (see T. Scitovszky, "A Note on Welfare Propositions in Economics," *Review of Economic Studies*, IX [1941], 77–88; P. A. Samuelson, *Foundations of Economic Analysis* [Cambridge, Mass., 1947], chap. viii).

[17] A. C. Pigou, *The Economics of Welfare* (4th ed.; London, 1932), chaps. ix and xi.

cumulation is subject to external diseconomies. What is the nature of these diseconomies?

If the marginal product of capital is less than the rate of interest, this can only mean, as I have argued above, that new savings bring about capital gains for assets already in existence. A capital gain arises because the cost in terms of foregone consumption of a given capital good has been increased, and this increase in cost represents a social cost analogous to an increase in the cost of producing a given commodity. Moreover, it is a cost which is not taken into account by the individual saver, and it may therefore be regarded as an external diseconomy of capital accumulation. Thus, when the social product of capital is less than its private product, we may say, in a sense, that the production of capital is subject to external diseconomies. And, like ordinary diseconomies, the external diseconomies in the production of capital cause its quantity to exceed the socially desirable amount.

It is perhaps unnecessary to consider in detail the converse case in which the marginal product of capital exceeds the rate of interest. Suffice it to say that in this event an increase in capital leads to capital losses; and the capital losses represent a social economy in the sense that the cost of capital goods, in terms of foregone current consumption, is reduced. Since the capital losses do not enter into the calculations of the individual saver, they constitute external economies in the production of capital. Like other external economies, they lead to a deficiency of "output," which in this instance means that the quantity of capital falls short of the optimal quantity.

Whether the amount of capital exceeds or falls short of an optimum is obviously a question which can be discussed rigorously only with reference to a stationary economy. In a growing economy the quantity of capital is continually increasing, and this means that the existing amount of assets is always less than the amount which savers wish, eventually, to hold. Of course, if the rate of growth of asset-holdings were carefully planned by all savers, one might conceive of a sort of moving equilibrium representing the increasing amount of capital the savers wished to hold at different periods of time. In this event, the welfare propositions concerning the optimal *quantity* of capital could be translated into similar propositions concerning the optimal *rate of growth* of capital. If the marginal product of capital exceeds the rate of interest in such a growing economy, for example, it might be argued that the rate of growth is less than the socially desirable rate. Conversely, if the marginal product of capital is less than the rate of interest, the above reasoning would lead to the conclusion that capital is being accumulated too rapidly.

Although both these propositions concerning a growing economy appear to be logically sound, neither of them can be accepted without serious reservations. Perhaps most important of all, one cannot assume that the rate of accumulation of assets is always a result of careful planning on the part of savers. To some extent capital accumulation is a function of fortuitous circumstances such as capital gains and losses; and, if savers simply hold whatever capital values happen to arise as the result of these gains and losses, there is no reason to suppose that the savers always equalize their private rate of substitution with the rate of interest. Such an equalization can be taken for granted only in a stationary state. A second reservation must be made for the presence of uncertainty. If an uncer-

tainty-premium is added to the rate of interest, the combined uncertainty-and-interest charge may be so large that any possible discrepancy between the rate of interest and the marginal product of capital is relatively insignificant by comparison. When both uncertainty and the unpredictable response of savers to capital gains and losses are taken into account, it becomes apparent that a discrepancy between the rate of interest and the marginal product of capital in a growing economy does not imply anything very definite concerning the optimal rate of growth.

THE DEVELOPMENT OF UTILITY THEORY. I

GEORGE J. STIGLER
Columbia University

But I have planted the tree of utility. I have planted it deep, and spread it wide.—BENTHAM.

THE history of economic thought can be studied with many purposes. One may trace the effects of contemporary economic and social conditions on economic theory or—rather more bravely—the effects of economic theories on economic and social developments. One may study the history to find the original discoverers of theories, spurred on by the dream of new Cantillons; or one may compare the economics of the great economists with that of the rank and file, as a contribution to the structure and process of intellectual change. Or one may, and most often does, simply set forth the major steps in the development of a branch of economic theory, hoping that it can be justified by its contribution to the understanding of modern economics. This history of utility theory is offered primarily with this last purpose, although in the final section I review the history to answer the question, "Why do economists change their theories?"

The scope of this study is limited in several respects. First, it covers primarily the period from Smith to Slutsky, that is, from 1776 to 1915. Second, the study is limited to certain important topics and to the treatment of these topics by economists of the first rank. The application of utility theory to welfare economics is the most important topic omitted. An estimate of the part played by utility theory in forming economists' views of desirable social policy is too large a task, in the complexity of issues and volume of literature involved, to be treated incidentally. The omission is justified by the fact that most economists of the period used utility theory primarily to explain economic behavior (particularly demand behavior) and only secondarily (when at all) to amend or justify economic policy.[1]

I. THE CLASSICAL BACKGROUND

ADAM SMITH

Drawing upon a long line of predecessors, Smith gave to his immediate successors, and they uncritically accepted, the distinction between value in use and value in exchange:

> The word VALUE, it is to be observed, has two different meanings, and sometimes expresses the utility of some particular object, and sometimes the power of purchasing other goods which the possession of that object conveys. The one may be called "value in use"; the other, "value in exchange." The things which have the greatest value in use have frequently little or no value in exchange; and on the contrary, those which have the greatest value in exchange have frequently little or no value in use. Nothing is more useful than water: but it will purchase scarce any thing; scarce any thing can be had in exchange for it. A diamond, on

[1] I have also omitted consideration of the criticisms raised by the antitheoretical writers, who played no constructive part in the development of the theory. For a discussion of some of their views see J. Viner, "The Utility Theory and Its Critics," *Journal of Political Economy*, XXXIII (1925), 369–87.

I wish to acknowledge the helpful suggestions of Arthur F. Burns, Milton Friedman, and Paul A. Samuelson.

the contrary, has scarce any value in use; but a very great quantity of other goods may frequently be had in exchange for it.[2]

The fame of this passage rivals its ambiguity.

The paradox—that value in exchange may exceed or fall short of value in use—was, strictly speaking, a meaningless statement, for Smith had no basis (i.e., no concept of marginal utility of income or marginal price of utility) on which he could compare such heterogeneous quantities. On any reasonable interpretation, moreover, Smith's statement that value in use could be less than value in exchange was clearly a moral judgment, not shared by the possessors of diamonds. To avoid the incomparability of money and utility, one may interpret Smith to mean that the ratio of values of two commodities is not equal to the ratio of their total utilities.[3] On such a reading, Smith's statement deserves neither criticism nor quotation.

This passage is not Smith's title to recognition in our history of utility. His role is different: it is to show that demand functions, as a set of empirical relationships, were already an established part of economic analysis. The negatively sloping demand curve was already axiomatic; for example, "A competition will immediately begin among [the buyers when an abnormally small supply is available], and the market price will rise more or less above the natural price."[4] The effect of income on consumption was not ignored:

> The proportion of the expence of house-rent to the whole expence of living, is different in the different degrees of fortune. It is perhaps highest in the highest degree, and it diminishes gradually through the inferior degrees, so as in general to be lowest in the lowest degree. The necessaries of life occasion the great expence of the poor. They find it difficult to get food, and the greater part of their little revenue is spent in getting it. The luxuries and vanities of life occasion the principal expence of the rich; and a magnificent house embellishes and sets off to the best advantage all the other luxuries and vanities which they possess. A tax upon house-rents, therefore, would in general fall heaviest upon the rich; and in this sort of inequality there would not, perhaps, be any thing very unreasonable.[5]

This type of demand analysis was continued and improved by Smith's successors, but his example should suffice to remind us that a history of utility is not a history of demand theory.

BENTHAM

Jeremy Bentham brought the principle of utility (to be understood much more broadly than is customary in economics) to the forefront of discussion in

[2] *The Wealth of Nations* (New York: Modern Library, 1937), p. 28.

[3] Or, alternatively, that the ratio of the prices of two commodities is not equal to the ratio of their total utilities; but this also requires an illegitimate selection of units: The price of what quantity of diamonds is to be compared with the price of one gallon of water? Smith makes such illegitimate statements; for example, "The whole quantity of a cheap commodity brought to market, is commonly not only greater, but of greater value, than the whole quantity of a dear one. The whole quantity of bread annually brought to market, is not only greater, but of greater value than the whole quantity of butcher's-meat; the whole quantity of butcher's meat, than the whole quantity of poultry; and the whole quantity of poultry, than the whole quantity of wild fowl. There are so many more purchases for the cheap than for the dear commodity, that, not only a greater quantity of it, but a greater value, can commonly be disposed of" (*ibid.*, p. 212; see also p. 838).

Nevertheless, this statement can be reformulated into a meaningful and interesting hypothesis: Order commodities by the income class of consumers, using the proportion of families in the income class that purchase the commodity as the basis for choosing the income class. Then does aggregate value of output fall as income class rises?

[4] *Ibid.*, p. 56. Substitution is illustrated by the effects of a royal death on the prices of black and colored cloth (*ibid.*, p. 59).

[5] *Ibid.*, pp. 793–94. This is of course the opposite of modern budgetary findings, but near-contemporary budget studies seem to me indirectly to support Smith.

England at the beginning of the nineteenth century. In his *Introduction to the Principles of Morals and Legislation* (1789) he suggested the measurement of quantities of pleasure and pain (primarily for the purpose of constructing a more rational system of civil and criminal law). Four dimensions of pleasure and pain were distinguished for the individual: (1) intensity, (2) duration, (3) certainty, and (4) propinquity.[6]

The first two dimensions are clearly relevant to the measurement of a pleasure, but the latter two are better treated as two of the factors which influence an individual's response to a particular pleasure or pain.[7] Bentham did not give explicit directions for calculating a given pleasure and indeed devoted a long chapter (vi) to "Circumstances Influencing Sensibility," which listed no less than thirty-two circumstances (such as age, sex, education, and firmness of mind) that must be taken into account in carrying out such a calculation.

The theory was much elaborated with respect to economic applications in *Traités de legislation* (1802), a lucid synthesis of many manuscripts made by his disciple, Étienne Dumont.[8] Bentham was particularly concerned with the problem of equality of income, and this raised the question of comparisons of the utilities of persons who might differ in thirty-two circumstances:

> It is to be observed in general, that in speaking of the effect of a portion of wealth upon happiness, abstraction is always to be made of the particular sensibility of individuals, and of the exterior circumstances in which they may be placed. Differences of character are inscrutable; and such is the diversity of circumstances, that they are never the same for two individuals. Unless we begin by dropping these two considerations, it will be impossible to announce any general proposition. But though each of these propositions may prove false or inexact in a given individual case, that will furnish no argument against their speculative truth and practical utility. It is enough for the justification of these propositions—1st, If they approach nearer the truth than any others which can be substituted for them; 2nd, If with less inconvenience than any others they can be made the basis of legislation.[9]

Thus, he achieved interpersonal comparisons, not by calculation, but by assumption, justified by the desirability (somehow determined) of its corollaries. This resort to a question-begging assumption was a fundamental failure of his project to provide a scientific basis for social policy: the scientific basis was being justified by the policies to which it led. In one of his manuscripts he argued that this assumption was merely an abbreviation and that the conclusions he deduced could be reached (more laboriously) without it,[10] which is not in general true.

[6] *Op. cit.*, chap. iv. In addition, two further "dimensions" were added for the appraisal of the total satisfaction of an "act": the consumption of a loaf of bread might be the pleasure to which the first four dimensions refer; the theft of the loaf might be the act. These additional dimensions were fecundity and purity; respectively, the chance of one pleasure leading to another and the chance of a pleasure not being followed by a pain.

[7] As Bentham indicated elsewhere (see *Works of Jeremy Bentham* [Edinburgh: Tait, 1843], I, 206; III, 214).

[8] The reliability of the presentation of Bentham's views has been attested by Élie Halévy, *La Formation du radicalisme philosophique* (Paris: Germer Baillière, 1901), Vol. I, Appendix I. Here the Hildreth translation of the *Traités* is used (London: Trübner, 1871).

[9] *Theory of Legislation*, p. 103.

[10] "'Tis in vain to talk of adding quantities which after the addition will continue distinct as they were before, one man's happiness will never be another man's happiness; a gain to one man is no gain to another: you might as well pretend to add 20 apples to 20 pears, which after you had done that could not be 40 of any one thing but 20 of each just as there was before. This addibility of the happiness of different subjects, however, when considered rigorously it may appear fictitious, is a postulatum without the allowance of which all political reasoning is at a stand: nor is it more

Having surmounted this obstacle no better than subsequent economists, Bentham proceeded to establish a set of propositions on the utility of income:[11]

1st. Each portion of wealth has a corresponding portion of happiness.
2nd. Of two individuals with unequal fortunes, he who has the most wealth has the most happiness.
3rd. The excess in happiness of the richer will not be so great as the excess of his wealth.[12]

Each of these propositions was elaborated, and the utility calculus was used to defend equality ("The nearer the actual proportion approaches to equality, the greater will be the total mass of happiness"), although equality was finally rejected in favor of security of property. As corollaries, gambling was utility-decreasing and insurance utility-increasing.[13]

In a manuscript written about 1782, Bentham attempted to set forth more clearly the precise measurement of utility.[14] We are given a definition of the unit of intensity:

> The degree of intensity possessed by that pleasure which is the faintest of any that can be distinguished to be pleasure, may be represented by unity. Such a degree of intensity is in every day's experience: according as any pleasures are perceived to be more and more intense, they may be represented by higher and higher numbers: but there is no fixing upon any particular degree of intensity as being the highest of which a pleasure is susceptible.[15]

(This suggested measure will be discussed in connection with the Weber-Fechner literature.) Then, shifting ground, Bentham argues that, although utility does not increase as fast as income, for small changes the two move proportionately,[16] so we may measure pleasures through the prices they command:

> If then between two pleasures the one produced by the possession of money, the other not, a man had as lief enjoy the one as the other, such pleasures are to be reputed equal. But the pleasure produced by the possession of money, is *as* the quantity of money that produces it: money is therefore the measure of this pleasure. But the other pleasure is equal to this; the other pleasure therefore is as the money that produces this: therefore money is also the measure of that other pleasure.[17]

Unfortunately, this procedure is illegitimate; we cannot use an equality (or, more strictly, a constancy of the marginal utility of money) that holds for small changes to measure total utilities.[18] These suggestions are impor-

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fictitious than that of the equality of chances to reality, on which that whole branch of the Mathematics which is called the doctrine of chances is established. The fictitious form of speech (expression) in both cases, which, fictitious as it is, can give birth to no false consequences or conclusions, is adopted from a necessity which induces the like expedient in so many other instances, merely for the sake of abbreviation: as it would be endless to repeat in every passage where it was used, what it was it wanted to be rigorously true" (Halévy, *op. cit.*, III, 481).

[11] *Theory of Legislation*, pp. 103 ff.; all statements italicized by Bentham.

[12] The use of marginal analysis was even more explicit in his *Pannomial Fragments:*

"But the quantity of happiness will not go on increasing in anything near the same proportion as the quantity of wealth:—ten thousand times the quantity of wealth will not bring with it ten thousand times the quantity of happiness. It will even be matter of doubt whether ten thousand times the wealth will in general bring with it twice the happiness.

". . . the quantity of happiness produced by a particle of wealth (each particle being of the same magnitude) will be less and less at every particle; . . ." (*Works*, III, 229; see also IV, 541).

[13] *Theory of Legislation*, pp. 106–7.

[14] Lengthy extracts are given by Halévy, *op. cit.*, Vol. I, Appendix II.

[15] *Ibid.*, p. 398.

[16] *Ibid.*, p. 408.

[17] *Ibid.*, p. 410.

[18] Bentham appears to have recognized this difficulty when, in a passage following a discussion of

tant chiefly in revealing Bentham's awareness of the crucial problems in his calculus and his ingenuity in attempting to solve them.[19]

Bentham had indeed planted the tree of utility. No reader could overlook the concept of utility as a numerical magnitude; and the implications for economic analysis were not obscure. But they were overlooked.

THE RICARDIANS

The economists of Bentham's time did not follow the approach he had opened. One may conjecture that this failure is due to the fact that Ricardo, who gave the economics of this period much of its slant and direction, was not a Benthamite. It is true that he was the friend of Bentham and the close friend of James Mill, Bentham's leading disciple. Yet there is no evidence that he was a devout utilitarian and much evidence that he was unphilosophical—essentially a pragmatic reformer.[20]

It is clear, in any event, that Ricardo did not apply the utility calculus to economics. He began his *Principles* with the quotation of Smith's distinction between value in use and value in exchange and ended the volume with the statement: "Value in use cannot be measured by any known standard; it is differently estimated by different persons."[21] I should be content to notice that he left the theory of utility as highly developed as he found it—as much cannot be said for the theory of value—were it not for a remarkable interpretation of Marshall's:

> Again, in a profound, though very incomplete, discussion of the difference between "Value and Riches" he seems to be feeling his way towards the distinction between marginal and total utility. For by Riches he means total utility, and he seems to be always on the point of stating that value corresponds to the increment of riches which results from that part of the commodity which it is only just worth the while of purchasers to buy; and that when the supply runs short, whether temporarily in consequence of a passing accident, or permanently in consequence of an increase in cost of production, there is a rise in that marginal increment of riches which is measured by value, at the same time that there is a diminution in the aggregate riches, the total utility, derived from the commodity. Throughout the whole discussion he is trying to say, though (being ignorant of the terse language of the differential calculus) he did not get hold of the right words in which to say it neatly, that marginal utility is raised and total utility is lessened by any check to supply.[22]

In the chapter (xx) referred to, Ricardo defines riches as "necessaries, conveniences, and amusements," and value, as usual, is measured by the amount of labor necessary to produce a commodity. The chapter is essentially an exercise in the paradoxes of this definition of value; for example, if the productivity of labor doubles, riches double, but value changes only if the number of laborers changes. We may properly identify "necessaries, conveniences, and amusements" with total

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diminishing marginal utility, he wrote: "[Intensity] is not susceptible of precise expression: it *not* being susceptible of measurement" (*Codification Proposal* [1822], in *Works*, IV, 542).

[19] For more general discussions of Bentham see W. C. Mitchell, "Bentham's Felicific Calculus," in *The Backward Art of Spending Money* (New York: McGraw-Hill Book Co., 1937); and J. Viner, "Bentham and J. S. Mill," *American Economic Review*, XXXIX (1949), 360–82.

[20] See Bonar's Preface to *Letters of Ricardo to Malthus* (Oxford: Clarendon, 1887).

[21] *Principles of Political Economy and Taxation* (Gonner ed.; London: Bell, 1932), p. 420.

[22] *Principles of Economics* (8th ed.; London: Macmillan, 1920), p. 814.

utility; but what of marginal utility? Ricardo says that, if a person receives two sacks of corn where formerly he received one, "he gets, indeed double the quantity of riches—double the quantity of utility—double the quantity of what Adam Smith calls value in use."[23] Hence he did not believe that marginal utility diminishes as quantity increases. He continued:

> When I give 2,000 times more cloth for a pound of gold than I give for a pound of iron, does it prove that I attach 2,000 times more utility to gold than I do to iron? certainly not; it proves only as admitted by M. Say, that the cost of production of gold is 2,000 times greater than the cost of production of iron . . . if utility were the measure of value, it is probable I should give more for the iron.[24]

The writer of this passage cannot be said to have been close to the notion of marginal utility. I cannot find a single sentence that gives support to Marshall's interpretation, and I think that it should be added to the list of examples of his peculiar documentation and interpretation of predecessors.

Ricardo's influence was such that James Mill, the logical person to apply Bentham's system to economics, was content to present a rigid simplification of Ricardo's *Principles*;[25] and his son—whose formative work in economics, we must remember, came chiefly in the 1820's—did little more with utility.[26] Only the French utilitarian, J. B. Say, attempted to give utility a substantial place in economic theory, and he was prevented from doing so effectively by his inability to arrive at a notion of marginal analysis. In order to support the thesis that prices are proportional to utilities, he was driven to invent the metaphysical distinction between natural and social wealth:

> One pays 2,000 times as much for a pound of gold as for a pound of iron. Here is how, on my theory, this phenomenon is explained. I assume with you that a pound of iron has the same utility as a pound of gold, although it is worth only one-two-thousandth as much. I say that there are in the iron 1,999 degrees of utility that nature has given us without charge, and 1 degree that we create by work, at an expense that we will assume only if a consumer is willing to reimburse us; hence the pound of iron has 2,000 degrees of utility. The gold also has 2,000 degrees of utility (on your assumption), which however can be obtained only on exacting terms, that is to say, . . . by expenses of 2,000. The 1,999 degrees of utility for which we do not pay when we consume iron are part of our natural wealth. . . . The single degree of utility which must be paid for is part of our social wealth.[27]

II. THE UNSUCCESSFUL DISCOVERERS

The principle that equal increments of utility-producing means (such as income or bread) yield diminishing increments of utility is a commonplace. The first statement in print of a commonplace is adventitious; it is of no importance in the development of economics, and it confers no intellectual stature on its author. The statement acquires interest only when it is logically developed or explicitly applied to economic problems, and it acquires importance only when a considerable number of economists are persuaded to incorporate it into their analyses. Interest and importance are of course matters of degree.

Some economists gave clear state-

[23] *Principles*, p. 265. [24] *Ibid.*, pp. 267–68.

[25] In his *Elements of Political Economy* (3d ed., 1827).

[26] *Principles of Political Economy* (Ashley ed.; New York: Longmans, Green, 1929), pp. 442–44, 804.

[27] Letter to Ricardo, July 19, 1821, in *Mélanges et correspondance* (Paris: Chamerot, 1833), pp. 116–17, 287–89; cf. also *Treatise on Political Economy* (Boston: Wells & Lilly, 1824), Book II, chap. i, and *Cours complet d'économie politique* (Paris: Guillaumin, 1840), I, 65–66, 71–72.

ments of the principle of diminishing marginal utility but did not apply it to economic problems; they include Lloyd (1833), Senior (1836), Jennings (1855), and Hearn (1864).[28] Others applied utility theory to economic events without explicitly developing the principle of diminishing marginal utility: A. Walras (1831) and Longfield (1834), for example.[29] At least two economists—in addition to Bentham—elaborated the principle or applied it to economic problems but failed to persuade other economists of its usefulness.[30] Their theories will be summarized briefly.

DUPUIT (1844)

Jules Dupuit, a distinguished engineer, was led to the marginal utility theory by his attempt to construct a theory of prices that maximize utility.[31] He distinguished total and marginal utility with great clarity and discovered "une espèce de bénéfice" that we now call *consumers' surplus*. It was defined as the excess of total utility over marginal utility times the number of units of the commodity, but it was actually taken to be the area under the demand curve minus the expenditures on the commodity (i.e., Marshall's measure without his restrictions).[32]

Armed with this concept, he investigated the optimum toll on a bridge.

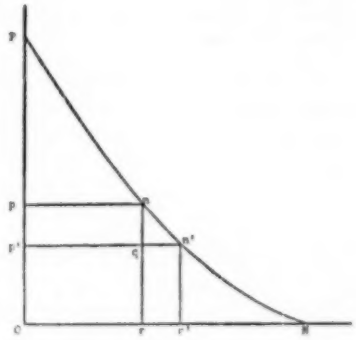

FIG. 1

His analysis was as follows. Let NP be the demand (and marginal utility) curve, Op the price (Fig. 1). Then $OrnP$ is the absolute utility consumers obtain from the use of the bridge, and pnP is the relative utility. If the toll is reduced by pp', there is a net gain of consumer utility of qnn' (equal to the area under the demand curve between r and r' minus the expenditure $rr'n'q$).

Dupuit's general conclusion is: "The utility of a means of communication, and in general of any product, is at a

[28] W. F. Lloyd, "The Notion of Value," reprinted in *Economic History, Economic Journal Supplement*, May, 1927, pp. 170–83; N. W. Senior, *Political Economy* (New York: Farrar & Rinehart, 1939), pp. 11–12; R. Jennings, *Natural Elements of Political Economy* (London: Longman, Brown, Green & Longmans, 1855), pp. 98–99, 119, 233 n.; W. E. Hearn, *Plutology* (London: Macmillan, 1864), p. 17. Lloyd, the third occupant of the Drummond chair in political economy at Oxford, gave much the most elaborate statement of the principle. Instead of applying it to contemporary economic problems, however, he emphasized the fact that marginal utility is not the same thing as exchange value and applied the theory to Robinson Crusoe to show this.

[29] A. Walras, *De la nature de la richesse et de l'origine de la valeur* (Paris: Alcan, 1938), esp. chap. xi; M. Longfield, *Lectures on Political Economy* ("London School Reprints" [London, 1931]), pp. 27–28, 45–46, 111 ff.

[30] Daniel Bernoulli's much earlier discovery will be treated later.

[31] His chief essays (published in 1844 and 1849) are reprinted in *De l'utilité et de sa mesure* (Torino: La Riforma Sociale, 1934).

[32] Dupuit's instruction for measuring utility reveals the tacit identification of utility and demand curves: "Assume that all the like commodities whose general utility one wishes to determine are subjected to a tax which is increased by small steps. At each increase, a certain quantity of the commodity will no longer be purchased. The utility of this quantity in terms of money will be the quantity multiplied by the tax. By increasing the tax until all purchases cease, and adding the partial products, one will obtain the total utility of the commodity" (*ibid.*, p. 50; also p. 180).

maximum when the toll or the price is zero."[33] This is little more than a tautology, and Dupuit did not draw the further and illegitimate conclusion that the optimum toll rate is zero:

> It will not be our conclusion [that tolls should be small or zero], when we treat of tariffs; but we hope to have demonstrated that [tariff rates] must be studied, combined on rational principles to produce simultaneously the greatest possible utility and a revenue which will repay the expense of maintenance and the interest on the capital investment.[34]

We see that he was not afraid of interpersonal comparisons of utility, and in fact he argued that the effects of price changes on the distribution of income must be ignored because they were merely transfers.[35]

Dupuit could not reach a complete theory of optimum prices because he did not devise a coherent theory of cost.[36] One is impressed by the narrowness of his vision; the explicit formulation of the concept of consumer surplus is elegant, but there is no intuition of the difficulties in the concept, nor is there an attempt to construct the larger theoretical framework necessary to solve his problem.

[33] *Ibid.*, p. 161. I have transposed the axes of Dupuit's diagram.

[34] *Ibid.*, p. 51. Elsewhere he says that the ideal toll would be one proportional to the consumers' total utility, but this is impracticable because of "l'improbité universelle" (*ibid.*, p. 141); and the effects of alternative methods of financing public works (e.g., the incidence of taxes) must be studied before a practical recommendation can be made (*ibid.*, p. 161). Multiple price systems were also considered (*ibid.*, pp. 64–65, 140 ff.).

[35] *Ibid.*, p. 52.

[36] This is illustrated by the following quotation, in which price fluctuations are treated as exercises of arbitrary power:

> "In order that there be an increase or decrease in utility, it is necessary that there be a decrease or increase in [a commodity's] cost of production—there being no change in its quality. When there are only variations in market price [prix vénal], the consumer gains what the producer loses, or conversely. Thus, when an article costing 20 francs to produce is sold for 50 francs, as a result of a monopoly or concession, the producer deprives every buyer of 30 francs of utility. If some circumstance forces him to lower his price by 10 francs, his income diminishes by 10 francs per unit and that of each buyer increases by 10 francs. There is a cancellation; no utility is produced" (*ibid.*, pp. 52–53).

GOSSEN (1854)

Heinrich Gossen is one of the most tragic figures in the history of economics. He was a profound, original, and untrained thinker who hid his thoughts behind painfully complex arithmetical and algebraic exercises.[37] He displayed every trait of the crank,[38] excepting only one: history has so far believed that he was right. Only a few distinctive features of his work will be commented upon.

First, Gossen's discussion of the laws of satisfaction is concerned only with individual acts of consumption, such as the eating of slices of bread.[39] Correspondingly, in his early diagrams marginal utility is a function of time (duration of the act of consumption), and only after a considerable elaboration of this approach does he take quantity of a (perishable) commodity as proportional to duration of consumption.[40]

[37] Only a person who has labored through the volume can savor the magnificent understatement of Edgeworth: "He may seem somewhat deficient in the quality of mathematical elegance" ("Gossen," *Palgrave's Dictionary of Political Economy* [London: Macmillan, 1923], II, 232).

[38] His *Entwickelung der Gesetze des menschlichen Verkehrs* (3d ed.; Berlin: Prager, 1927), which is not encumbered with chapters, begins with the famous sentences: "On the following pages I submit to public judgment the result of 20 years of meditation. What a Copernicus succeeded in explaining of the relationships of worlds in space, that I believe I have performed for the explanation of the relationships of men on earth."

[39] For a good summary see M. Pantaleoni, *Pure Economics* (London: Macmillan, 1898), pp. 28 ff.

[40] *Entwickelung*, p. 29; his treatment of durable goods is not sound (see pp. 25, 29–30).

Yet he does not attempt to work out a theory of the temporal pattern of consumption, and this portion of his theory seems misdirected.

Second, he presents a theory of the marginal disutility of labor that is completely symmetrical with that of the marginal utility of consumer goods. Gossen's curve of the marginal disutility of income is essentially identical with that which Jevons made famous: the early hours of work yield utility, but, as the duration of labor increases, the marginal utility diminishes to zero and then to negative values.[41] He defines the condition of maximum utility as that in which the marginal utility of a unit of product is numerically equal to the marginal disutility of the labor necessary to produce a unit of product.[42]

Third, Gossen was the first writer to formulate explicitly what I shall call the fundamental principle of marginal utility theory:

> A person maximizes his utility when he distributes his available money among the various goods so that he obtains the same amount of satisfaction from the last unit of money (*Geldatom*) spent upon each commodity.[43]

We may translate this statement into semisymbolic form:

$$\frac{MU_1}{p_1} = \frac{MU_2}{p_2} = \frac{MU_3}{p_3} = \cdots,$$

where MU_i represents the marginal utility of the ith commodity and p_i its price. (We shall adhere to the notation: x_i is the quantity of commodity X_i, p_i is its price, MU_i is its marginal utility, and R is money income.) This equation marked a long step forward in the development of the relationship between utility and demand curves.

Finally, Gossen's views on the measurability of utility are vague but tantalizing:

> We can conceive of the magnitudes of various pleasures only by comparing them with one another, as, indeed, we must also do in measuring other objects. We can measure the magnitudes of various areas only by taking a particular area as the unit of measurement, or the weights of different bodies only by taking a particular weight as the unit. Similarly, we must fix on one pleasure as our unit, and hence an indefiniteness remains in the measurement of a pleasure. It is a matter of indifference which pleasure we choose as the unit. Perhaps the consequences will be most convenient if we choose the pleasure from the commodity which we use as money.[44]

He did not notice that there might be no unit of utility comparable with that of area or weight; and it is probably going too far to read into this passage the later position that it is sufficient to deal with the ratios of marginal utilities.

III. THE BEGINNINGS OF THE MODERN THEORY

The utility theory finally began to win a place in generally accepted economics in the 1870's, under the triple auspices of Jevons, Menger, and Walras. Independently these economists arrived at positions similar in the main and sometimes in detail.[45] I shall compare their treatments of certain basic

[41] *Ibid.*, p. 36.

[42] *Ibid.*, p. 45.

[43] *Ibid.*, pp. 93–94.

[44] *Ibid.*, p. 123.

[45] Marshall was a contemporary discoverer of the theory but did not publish it until later (*Memorials of Alfred Marshall* [London: Macmillan, 1925], p. 22). J. B. Clark was a somewhat later discoverer and never developed the theory to a level comparable with the best contemporary European analysis. He became preoccupied with a neglected problem to which he could not find a useful solution: how to apply marginal analysis to variations in the quality of goods (see *The Philosophy of Wealth* [Boston: Ginn & Co., 1892], Preface and p. 76 n.; *Distribution of Wealth* [New York: Macmillan, 1931], chaps. xiv–xvi).

problems of the theory, and henceforth our organization will be by subject.

A. CRITICISM OF RECEIVED DOCTRINE

Each of these founders of utility theory criticized the Ricardian theory of value, but for each this was an incidental and minor point; they deemed the positive merits of the utility theory a sufficient basis for acceptance. Thus, only after completing the presentation of his utility theory did Jevons point out the deficiencies in Ricardo's labor value theory. These deficiencies were three: (1) Ricardo required a special theory for commodities with fixed supplies, such as rare statues. This proved that labor cost is not essential to value. (2) Large labor costs will not confer high value on a commodity if the future demand is erroneously forecast; "in commerce bygones are for ever bygones."[46] (3) Labor is heterogeneous, and the various types of labor can be compared only through the values of their products.[47] On the other hand, the cost of production theory of value fits in nicely as a special case of the utility theory, for it explains the relative quantities of commodities that will be supplied.[48]

Menger and Walras took fundamentally the same position. The former also gave the first two criticisms listed above and, in addition, made a parallel criticism to the Ricardian rent theory: if the value of land did not depend upon labor cost, this demonstrated a serious lack of generality in the classical theory of value.[49] Walras repeated the criticism that the classical theory lacked generality, emphasized the reciprocal effects of prices of products and of productive services on one another, and denied the existence of the class of commodities whose supplies could be infinitely increased, on the overly literal ground that no productive resource was available in infinite quantity.[50]

The task of elaborating and expounding the theory, and of exaggerating its merits and understating the usefulness of the classical theory—the inevitable accompaniments of intellectual innovations—fell largely to disciples, in particular Wieser and Böhm-Bawerk. These men did not improve on the substance of the theory—in fact, it deteriorated in their hands—so we shall pass them by.[51]

B. THE EXISTENCE AND MEASURABILITY OF UTILITY

Without exception, the founders accepted the existence of utility as a fact of common experience, congruent with the most casual introspection. Jevons was most explicit:

> The science of Economics, however, is in some degree peculiar, owing to the fact . . . that its ultimate laws are known to us immediately by intuition, or, at any rate, they are furnished to us ready made by other mental or physical sciences.
>
> . . . The theory here given may be described as *the mechanics of utility and self-interest*. Oversights may have been committed in tracing

[46] *Theory of Political Economy* (4th ed.; London: Macmillan, 1911), p. 164.

[47] *Ibid.*, p. 166.

[48] *Ibid.*, p. 165.

[49] *Grundsätze der Volkswirtschaftslehre* (Vienna: Braumüller, 1871), pp. 69, 120–21, 144–45.

[50] *Éléments d'économie politique pure* (1926 ed.; Paris: Pichon & Durand-Auzias), Leçon 38. The first edition (Lausanne: Carbay, 1874) does not differ materially in substance on the subjects discussed here.

[51] Wieser's paradox of value (that marginal utility times quantity may decrease when quantity increases) led to deep confusion (see *Natural Value* [New York: Stechert, 1930], Books I and II). Böhm-Bawerk's greatest polemic is *Grundzüge der Theorie des wirtschaftlichen Güterwerts* ("London School Reprints" [London, 1932]).

out its details, but in its main features this theory must be the true one. Its method is as sure and demonstrative as that of kinematics or statics, nay, almost as self-evident as are the elements of Euclid. . . .[52]

I am inclined to interpret the silence of Menger and Walras on the existence of utility as indicative of an equally complete acceptance.

Menger glossed over the problem of measurability of utility. He represented marginal utilities by numbers and employed an equality of marginal utilities in various uses as the criterion of the optimum allocation of a good.[53] His word for utility — *Bedeutung* — was surely intentionally neutral, but probably it was chosen for its nonethical flavor.[54] Walras was equally vague; he simply assumed the existence of a unit of measure of intensity of utility and thereafter spoke of utility as an absolute magnitude.[55]

Jevons' attack on the problem of measurability was characteristically frank and confused. He denied that utility was measurable:

There is no unit of labour, or suffering, or enjoyment.

I have granted that we can hardly form the conception of a unit of pleasure or pain, so that the numerical expression of quantities of feeling seems to be out of question.[56]

Yet he seemed also to argue that one cannot be sure that utility is not measurable but only that it could not presently be measured.[57] He was somewhat more skeptical of the measurability of utility in the first (1871) than in the second (1879) edition; for example, in the second edition he deleted the following passage:

I confess that it seems to me difficult even to imagine how such estimations [of utility] and summations can be made with any approach to accuracy. Greatly though I admire the clear and precise notions of Bentham, I know not where his numerical data are to be found.[58]

With gallant inconsistency, he proceeded to devise a way to measure utility. It employed the familiar measuring rod of money:

It is from the quantitative effects of the feelings that we must estimate their comparative amounts.

I never attempt to estimate the whole pleasure gained by purchasing a commodity; the theory merely expressed that, when a man has purchased enough, he would derive equal pleasure from the possession of a small quantity more as he would from the money price of it.[59]

This position is elaborated ingeniously: We can construct a demand curve by observation (or possibly experiment), and then we can pass to the marginal utility curve by means of the equation,

$$MU_r p_i = MU_i ,$$

where MU_r is the marginal utility of income.[60]

For the first approximation we may assume that the general utility of a person's income is not affected by the changes of price of the commodity. . . .

The method of determining the function of utility explained above will hardly apply, however, to the main elements of expenditure. The price of bread, for instance, cannot be properly brought under the equation in question, because, when the price of bread rises much, the resources of poor persons are strained, money

[52] *Op. cit.*, pp. 18 and 21.

[53] *Op. cit.*, p. 98 n.

[54] On one occasion he states that his numbers represent only relative utilities and that numbers such as 80 and 40 indicate only that the former (marginal) utility is twice as large as the latter (*ibid.*, p. 163 n.).

[55] *Éléments*, pp. 74, 102, 153.

[56] *Op. cit.*, pp. 7 and 12. [57] *Ibid.*, pp. 7–9.

[58] *Theory of Political Economy* (1st ed.; London: Macmillan, 1871), p. 12.

[59] *Theory* (4th ed.), pp. 11 and 13.

[60] *Ibid.*, pp. 146 ff. (Our notation.)

becomes scarcer with them, and $[MU_r]$, the [marginal] utility of money, rises.[61]

This procedure is so similar to Marshall's that we may defer comment until we discuss the latter's more elaborate version.

Unlike Walras and Menger, Jevons considered the question of the interpersonal comparison of utilities. He expressly argued that this was impossible[62] but made several such comparisons, as we shall notice later. Menger avoided the subject and did not engage in such comparisons; and Walras made only incidental interpersonal comparisons.[63]

C. UTILITY MAXIMIZATION AND THE DEMAND CURVE

Menger simply ignored the relationship between utility and demand. He was content to set some demand prices (he worked always with discontinuous schedules) which somehow represented marginal utilities[64] and proceeded to an elementary discussion of pricing under bilateral monopoly (the indeterminacy of which was recognized), duopoly (the complications of which were not recognized—a competitive solution was given), and competition (in which the absence of a theory of production had predictable effects).[65]

Jevons' attempt to construct a bridge between utility and demand was seriously hampered, I suspect, by his inability to translate any but simple thoughts into mathematics. His fundamental equation for the maximization of utility in exchanges was presented as a *fait accompli:*

$$\frac{MU_1}{MU_2} = \frac{p_1}{p_2}.$$

This equation was satisfactory for an individual confronted by fixed prices, but how to apply it to competitive markets?

Jevons devised two concepts to reach the market analysis: the trading body and the law of indifference. A trading body was the large group of buyers or sellers of a commodity in a competitive market.[66] The law of indifference was that there be only one price in a market.[67]

He proceeded in the following peculiar manner. Let the equation of exchange be applied to each trading body; for each group of competitive individuals the equation will determine the relationship between the quantity offered and the quantity demanded.[68] Hence we have two equations to determine the two unknowns: the quantities

[61] *Ibid.*, pp. 147 and 148.

[62] *Ibid.*, p. 14.

[63] See *Études d'économie politique appliquée* (Lausanne: Rouge, 1898), pp. 295 ff.; *Études d'économie sociale* (Lausanne: Rouge, 1896), pp. 209 ff.

[64] "The value that a good has for an economizing individual is equal to the significance of that want-satisfaction" (*op. cit.*, p. 120; also chap. v).

[65] *Ibid.*, pp. 177 ff., 208–9.

[66] The requirement of competition was indirect: one characteristic of a perfect market was that "there must be no conspiracies for absorbing and holding supplies to produce unnatural ratios of exchange" (*Theory* [4th ed.], p. 86). It is evident that the trading body could not properly be used to explain prices, because its composition depended upon prices.

[67] Jevons (*ibid.*, p. 95) stated the law of indifference as

$$\frac{dx_2}{dx_1} = \frac{x_2}{x_1}.$$

This notation is ambiguous (see Marshall, *Memorials*, p. 98; F. Y. Edgeworth, *Mathematical Psychics* [London: Paul, 1881], pp. 110 ff.).

[68] Jevons seems to have introduced the trading bodies to get quickly to market prices, not because of an intuition that bilateral monopoly was indeterminate; at least he overlooked the difficulties in duopoly (*Theory* [4th ed.], p. 117).

of x_1 and x_2 exchanged. Quite aside from the ambiguous concept of a trading body, this procedure was illicit on his own view that utilities of different individuals are not comparable.[69]

Walras succeeded in establishing the correct relationship between utility and demand. He first derived the equations of maximum satisfaction for an individual: if there are m commodities, and a unit of commodity x_1 is the *numéraire* in terms of which the prices of other commodities are expressed (so $p_1 = 1$), we have $(m - 1)$ equations:[70]

$$MU_1 = \frac{MU_2}{p_2} = \frac{MU_3}{p_3} = \dots .$$

Finally, the budget equation states the equality of values of the initial stocks of commodities (x_i^0) and the stocks held after exchange:

$$x_1 + x_2 p_2 + x_3 p_3 + \dots = x_1^0 + x_2^0 p_2 + x_3^0 p_3 + \dots .$$

We thus have m equations to determine the m quantities of the commodities demanded or supplied by the individual. We may solve the equations for the quantities demanded or supplied as functions of the prices:

$$x_2 = x_2(p_2, p_3, \dots)$$
$$x_3 = x_3(p_2, p_3, \dots)$$
$$\dots\dots\dots\dots\dots$$

[69] "The reader will find, again, that there is never, in any single instance, an attempt made to compare the amount of feeling in one mind with that in another" (*ibid.*, p. 14).

[70] *Éléments*, Leçon 8. Let total utility $= f(x_1) + g(x_2) + h(x_3) + \dots$. In one of these utility functions, substitute the budget limitation,

$$x_1 + x_2 p_2 + x_3 p_3 + \dots = x_1^0 + x_2^0 p_2 + x_3^0 p_3 + \dots ,$$

where $x_1^0, x_2^0, x_3, \dots$, are the initial stocks. Then maximize total utility to obtain the equations in the text.

$$x_1 = (x_1^0 + x_2^0 p_2 + x_3^0 p_3 + \dots) - (x_2 p_2 + x_3 p_3 + \dots) .$$

The $x_1, x_2, x_3, \dots$, are the quantities held (demanded), and $(x_1^0 - x_1), (x_2^0 - x_2), (x_3^0 - x_3), \dots$, the quantities supplied.[71]

To determine the market prices, we simply add the demands of all n individuals in the market for each commodity

$$X_2 = \sum^n x_2 = \sum^n x_2(p_2, p_3, \dots)$$
$$X_3 = \sum^n x_3 = \sum^n x_3(p_2, p_3, \dots)$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$$

and equate the quantities demanded to the quantities available (X_i^0)

$$X_2^0 = X_2$$
$$X_3^0 = X_3$$
$$\dots\dots$$

There are $(m - 1)$ such equations with which to determine the $(m - 1)$ prices of $x_2, x_3, \dots$, in terms of x_1. It may appear that we have forgotten the budget equation, but it is not an independent relationship because it can be deduced from the other equations. If we multiply the last set of equations by the respective prices of the commodities and add, we obtain

$$p_2(X_2^0 - X_2) + p_3(X_3^0 - X_3) + \dots = 0 .$$

But if we add the individual budget equations we obtain

$$\sum^n x_1 - X_1^0 = p_2(X_2^0 - X_2) + p_3(X_3^0 - X_3) + \dots = 0 .$$

[71] This summary differs in notation and detail, but not in substance, from Walras' exposition (*ibid.*, pp. 123 ff.). The chief difference of detail is that Walras writes the utility as $f(x_i^0 + x_i)$, where I write it as $f(x_i)$, so his x_i can be negative.

Hence if the quantity demanded equals the quantity available in $(m - 1)$ markets, the equality must also hold in the mth market. This is equivalent to saying that if we know the amounts of $(m - 1)$ commodities that have been exchanged for each other and an mth commodity, and the rates of exchange, we necessarily know the amount of the mth commodity exchanged.

The (Walrasian) demand function is thus the relationship between the quantity of a commodity and all prices, when the individual's (or individuals') money income and tastes (utility functions) are held constant. We shall adhere to this meaning of the demand function or "curve" (the two-dimensional illustration of course requiring that all prices except that of the commodity are held constant), and the relationship between quantity and money income (all prices and tastes being held constant) will be designated as the income curve.

D. THE APPLICATIONS OF THE THEORY

Jevons gave only one application of his utility theory: a demonstration that both parties to an exchange gain satisfaction. The demonstration, as he gave it, was inconsistent with his denial of the possibility of comparing utilities of individuals, for it rested on the marginal utility curves of nations.[72]

Menger was even less specific but surely vastly more persuasive in his applications of the theory: he made it the basis of economic theory. The theory was given many everyday illustrations (mostly hypothetical, to be sure): it explained exchange, the wages of textile workers during the Civil War cotton shortage, the shifts of goods between free and economic, etc. More important, the theory of production became simply an instance of the theory of marginal utility: productive services were distinguished from consumption services only in being goods of higher order. Menger's version had no predictive value, nor did he conjecture any new economic relationships. Indeed at least two of the founders of marginal utility theory—Jevons was the exception—knew much less about economic life than a dozen predecessors such as Smith and Babbage. Yet the theory served to systematize a variety of known facts of everyday observation and seemed to confer an air of generality and structural elegance upon price theory.

Walras also did a good deal of this reorientation of economic theory in terms of utility, whereby the value of productive services was determined by the values of products. But he also attempted a specific and natural application of the theory to demand-curve analysis.

This application was the derivation of the law that price reductions will increase the quantity demanded; price increases will decrease the quantity demanded.[73] Walras treated this as intuitively obvious, but it was a strict implication of his theory. Consider the equations of maximum satisfaction:

$$\frac{MU_1}{p_1} = \frac{MU_2}{p_2} = \frac{MU_3}{p_3} = \dots .$$

Assume p_2 falls by δp_2, and assume that the individual is deprived of his nominal increase in real income, $x_2 \delta p_2$. At the new price, $p_2 - \delta p_2$, the individ-

[72] *Theory* (4th ed.), pp. 142 ff. In the Preface to the second edition he proposed broader applications much closer to those of Menger and Walras but never worked out this position.

[73] *Éléments*, pp. 131, 133.

ual obtains a larger marginal utility per dollar from X_2 than from other commodities, hence he will substitute X_2 for other commodities. Restore now the increment of income $x_2\delta p_2$, and it will be used to purchase more of every commodity, including x_2. The individual necessarily buys more X_2 at a lower price, and therefore all individuals buy more of X_2 at a lower price: the demand curve for each product must have a negative slope.[74]

A second application of utility theory was made in the theorem on the distribution of stocks: a redistribution of initial stocks of goods among the individuals in a market, such that each individual's holdings have the same market value before and after the redistribution, will not affect prices.[75] It is the amount of income, not its composition in terms of goods, that influences consumer behavior. The most interesting point with respect to this obvious theorem is that Walras stopped here on the threshold of the analysis of the effects of income upon consumption. One may conjecture that his penchant for analyzing what are essentially barter problems in his theory of exchange played a large role in this failure to analyze income effects.[76]

The theory of utility also led Walras to his theory of multiple equilibria.[77] This theory deals with the exchange of one commodity for another in a competitive market, when both commodities have utility to the individual.[78] The possessors of X_1 have a fixed stock—how much will they offer at various prices of X_1 (in terms of X_2)? When p_1 is zero (no X_2 is given in exchange for a unit of X_1), they will naturally supply no X_1; the supply curve begins at (or above) the origin. At higher p_1, they will offer more X_1 to obtain more X_2, but beyond a certain price, L, further increases in the price of X_1 will lead them to reduce the quantity of X_1 offered because they become relatively sated with X_2. Walras illustrates this with Figure 2, where D is the demand curve and S the supply curve. A' and A'' are points of stable equilibrium, be-

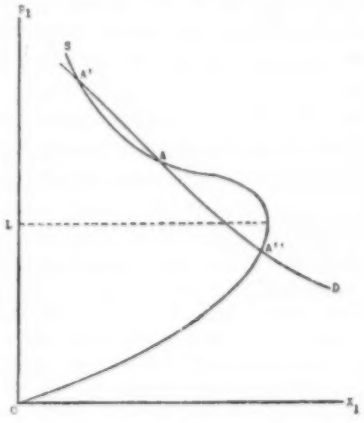

FIG. 2

[74] The validity of this argument depends on the assumption that the marginal utility of a commodity is a (diminishing) function only of the quantity of that commodity (see Sec. IV).

[75] *Ibid.*, pp. 145–49.

[76] Perhaps mention should also be made of the applications of utility theory to labor. Jevons' theory of disutility was labored and at times confused (see my *Production and Distribution Theories* [New York: Macmillan, 1941], chap. ii). Walras' treatment was more elegant—he introduced the marginal utility of leisure in complete symmetry to the theory of consumption—but not much more instructive (*Éléments*, p. 209). Menger denied that labor was usually painful (*op. cit.*, p. 149 n.).

[77] Marshall's theory of multiple equilibria is independent of utility analysis; it refers only to the long run, whereas Walras' theory is strictly short run. See Marshall, *Pure Theory of Domestic Values* ("London School Reprints" [London, 1930]).

[78] *Éléments*, pp. 68–70; Wicksell restates the theory, *Lectures on Political Economy* (London: Macmillan, 1934), I, 55 ff.

cause at higher prices the quantity supplied exceeds the quantity demanded and at lower prices the quantity demanded exceeds the quantity supplied. Point A, however, is an unstable equilibrium because at higher prices the quantity demanded exceeds the quantity supplied so the price rises even more, and conversely at lower prices. We shall not follow the history of multiple equilibria, in which economists have usually taken an apprehensive pride.

In the area of welfare economics, Walras' most important application was the theorem on maximum satisfaction:

> Production in a market governed by free competition is an operation by which the [productive] services may be combined in products of appropriate kind and quantity to give the greatest possible satisfaction of needs within the limits of the double condition that each service and each product have only one price in the market, at which supply and demand are equal, and that the prices of the products are equal to their costs of production.[79]

This theorem, which is not true unless qualified in several respects, gave rise to an extensive literature which lies outside our scope.[80]

[79] *Éléments*, p. 231; Jevons also stated the theorem (*Theory* [4th ed.], p. 141).

[80] Among the important writings during our period are: A. Marshall, *Principles of Economics* (1st ed.; London: Macmillan, 1890), Book V, chap vii; V. Pareto, "Il Massimo di utilità dato dalla libera concorrenza," *Giornale degli economisti*, Series 2, No. 9 (July, 1894), pp. 48–66; E. Barone, "The Ministry of Production in the Collectivist State," reprinted in F. A. Hayek, *Collectivist Economic Planning* (London: Routledge, 1938); K. Wicksell, *Lectures on Political Economy* (London: Macmillan, 1934), I, 72 ff.; L. Bortkewitch, "Die Grenznutzentheorie als Grundlage einer ultra-liberalen Wirtschaftspolitik," *Jahrbuch für Gesetzgebung, Verwaltung und Volkswirtschaft*, XXII (1898), 1177–1216; and A. C. Pigou, *Wealth and Welfare* (London: Macmillan, 1912).

IV. THE FORM OF THE UTILITY FUNCTION

The three founders of the utility theory treated the utility of a commodity as a function only of the quantity of that commodity. If $x_1, x_2, x_3, \ldots$, are the commodities, the individual's total utility was written (explicitly by Jevons and Walras, implicitly by Menger), as

$$f(x_1) + g(x_2) + h(x_3) + \ldots .$$

They further assumed that each commodity yielded diminishing marginal utility. This form of utility function has the implication that the demand curve for each commodity has a negative slope, as I have already remarked. It has also the implication that an increase in income will lead to increased purchases of every commodity. This is easily shown with the fundamental equations,

$$MU_r = \frac{MU_1}{p_1} = \frac{MU_2}{p_2} = \frac{MU_3}{p_3} = \ldots .$$

If income increases, the marginal utility of every commodity (and of income) must decrease, but the marginal utility of a commodity can be reduced only by increasing its quantity. This implication was not noticed.

Edgeworth destroyed this pleasant simplicity and specificity when he wrote the total utility function as $\varphi(x_1, x_2, x_3, \ldots)$. He appears to have made this change partly because it was mathematically more general, partly because it was congruent with introspection.[81] The change had important implications for the measurability of utility that I shall discuss in Section V.

With the additive utility function, diminishing marginal utility was a sufficient condition for convexity of the in-

[81] *Mathematical Psychics*, pp. 20, 34, 104, 108.

difference curves;[82] with the generalized utility function, diminishing marginal utility was neither necessary nor sufficient for convex indifference curves.[83] Nevertheless, Edgeworth unnecessarily continued to assume diminishing marginal utility, but he also postulated the convexity of the indifference curves.[84]

Even with convexity, the generalized utility function no longer has the corollary that all income curves have positive slopes (or, therefore, that all demand curves have negative slopes). After a price reduction, δp_2, we may again segregate the effect of a change in relative prices by temporarily reducing the individual's income by $x_2\delta p_2$. When we restore this increment of real income, we cannot be sure that each commodity will be consumed in larger quantity. Suppose an increase in X_1 reduces the marginal utility of X_2. Then when a portion of the increment of real income $x_2\delta p_2$ is spent on X_1, MU_2 may diminish so much that the amount of X_2 must be reduced below its original quantity to fulfil the maximum satisfaction conditions.[85]

The only further generalization of the utility function (aside from questions of measurability) was the inclusion of the quantities consumed by other people in the utility function of

[82] Diminishing marginal utility for each commodity was not necessary, however: the indifference curves could be convex to the origin if every commodity except one yielded diminishing marginal utility, and the marginal utility of this exception commodity did not increase too rapidly. This exceptional case was first analyzed by Slutsky (see Sec. VII).

[83] In the two-commodity case

$$\frac{dx_2}{dx_1} = -\frac{\varphi_1}{\varphi_2}$$

is the slope of an indifference curve, and the condition for convexity is

$$\frac{d^2x_2}{dx_1^2} = -\frac{\varphi_2^2\varphi_{11} - 2\varphi_1\varphi_2\varphi_{12} + \varphi_1^2\varphi_{22}}{\varphi_2^3} > 0$$

where the subscripts to φ denote partial differentiation with respect to the indicated variables. It is clear that diminishing marginal utility (φ_{11} and φ_{22} negative) is not necessary for convexity, since φ_{12} can be positive and large, and it is not sufficient, since φ_{12} can be negative and large. In the additive case ($\varphi_{12} = 0$), at most one marginal utility can be increasing, as was pointed out in the previous footnote.

[84] *Mathematical Psychics*, p. 36. He wrote the tility function as $\varphi(x_1, -x_2)$, in my notationu, for reasons which will be pointed out below. He postulated that $\varphi_{12} < 0$, where $-X_2$ is work done by the person and X_1 is remuneration received. This is equivalent to assuming that an increase in remuneration increases the marginal utility of leisure, and would be represented by $\varphi_{12} > 0$ if we write the function as $\varphi(x_1, x_2)$, as is now customary. With diminishing marginal utility this condition leads to convexity (see previous note).

[85] The conditions for maximum satisfaction are

$$\frac{\varphi_1}{\varphi_2} = \frac{p_1}{p_2},$$
$$x_1p_1 + x_2p_2 = R.$$

Differentiate these equations with respect to R (holding prices constant) and solve to obtain

$$\frac{\partial x_2}{\partial R} = \frac{p_2\varphi_{11} - p_1\varphi_{12}}{p_2^2\varphi_{11} - 2p_1p_2\varphi_{12} + p_1^2\varphi_{22}}.$$

The denominator of the right side is negative if the indifference curves are convex to the origin. The numerator, however, can be positive with $\varphi_1 < 0$, so the whole expression may be negative (X_2 may be "inferior"). With the additive function, $\varphi_{12} = 0$ (and of course they assumed $\varphi_{ii} < 0$), so the expression must be positive (X_2 [and X_1] must be "normal"). Similarly, differentiate the equations with respect to p_2 holding p_1 and R constant) and solve to obtain

$$\frac{\partial x_2}{\partial p_2} = \frac{p_1\varphi_1 + x_2p_1\varphi_{12} - x_2p_2\varphi_{11}}{p_2^2\varphi_{11} - 2p_1p_2\varphi_{12} + p_1^2\varphi_{22}}.$$

Again the denominator is negative, and the numerator may be negative if φ_{12} is negative, so the whole expression may be positive. With the additive utility function and diminishing marginal utility, the expression must be negative.

the individual. Thus one's pleasure from diamonds is reduced if many other people have them (or if none do!), and one's pleasure from a given income is reduced if others' incomes rise. This line of thought is very old,[86] but it was first introduced explicitly into utility analysis in 1892. Fisher casually suggested it:

> Again we could treat [utility] as a function of the quantities of each commodity produced or consumed by *all persons* in the market. This becomes important when we consider a man in relation to the members of his family or consider articles of fashion as diamonds, also when we account for that (never thoroughly studied) interdependence, the division of labor.[87]

Henry Cunynghame made the same suggestion more emphatically in the same year:

> Almost the whole value of strawberries in March, to those who like this tasteless mode of ostentation, is the fact that others cannot get them. As my landlady once remarked, "Surely, sir, you would not like anything so common and cheap as a fresh herring?" The demand for diamonds, rubies, and sapphires is another example of this.[88]

Pigou took up this argument, used it to show that consumer surpluses of various individuals cannot be added, but decided that these interrelationships of individuals' utilities were stable (and hence did not vitiate the consumer surplus apparatus) when the price changes were small.[89] It was only proper that Marshall's leading pupil should postulate the constancy of the marginal utility of prestige.

Pigou's article elicited the first statistical investigation designed to test a utility theory (and apparently the only such investigation during the period). Edgeworth, a Fellow of All Souls, collected statistics from "a certain Oxford College" to determine "whether the size of the party has any influence upon the depth of the potations"—that is, upon the per capita consumption of wine. The data were presented in relative form lest they "should excite the envy of some and the contempt of others"; the conclusion was that the effect of the size of party was inappreciable.[90]

A few subsequent attempts have been made to revive this extension of the utility function to include the effect on one person's utility of other people's consumption, but the main tradition has ignored the extension. This neglect seems to have stemmed partly from a belief in the unimportance of the effect and partly from the obstacles it would put in the way of drawing specific inferences from utility analysis.

There remain three subordinate topics that may conveniently be discussed here. They are (*a*) the graphical exposition of the theory of the generalized utility function; (*b*) the attitude of contemporary economists toward Edgeworth's generalization; and (*c*) the Bernoulli hypothesis on the shape of the utility function.

[86] E.g.: A. Smith, *Theory of Moral Sentiments* (Boston: Wells & Lilly, 1817), Part III, chap. iii; Part IV, chap. i; N. F. Canard, *Principes d'économie politique* (Paris: Buisson, 1801), chap. v; Senior, *op. cit.*, p. 12.

[87] *Mathematical Investigations in the Theory of Value and Prices* (New Haven: Yale University Press, 1937—reprint of 1892 ed.), p. 102. Fisher independently reached the generalized utility function of Edgeworth (*ibid.*, Preface).

[88] "Some Improvements in Simple Geometrical Methods of Treating Exchange Value, Monopoly, and Rent," *Economic Journal*, II (1892), 37.

[89] "Some Remarks on Utility," *Economic Journal*, XIII (1903), 60 ff. He wrote the utility function of the individual as

$$U = \phi [x, y, z, w, K(ab)],$$

where x, y, z, and w were quantities consumed by the individual, a_i was the quantity of x possessed by some other individual i, whose social distance was b_i, and K was a symbol "akin to, though not identical with, the ordinary Σ" (*ibid.*, p. 61).

[90] *Papers Relating to Political Economy* (London: Macmillan, 1925), II, 323–24 n.

A. INDIFFERENCE CURVES

With the introduction of the interrelationship of utilities of commodities, it was no longer possible to portray total utility graphically in two dimensions. Edgeworth devised indifference curves, or contour lines, to permit of a graphical analysis of utility in this case. In itself this was merely an expositional advance, but it merits summarization because of its great popularity in modern times and because it later invited attention to questions relating to the measurability of utility.

We restrict ourselves to the case of two commodities, as Edgeworth and almost everyone since has done in graphical analysis.[91] We define the indifference curve as the combinations of X_1 and X_2 yielding equal satisfaction, i.e., $\varphi(x_1,x_2) = \text{constant}$. Edgeworth chose an asymmetrical graphical illustration of these curves that had a definite advantage for his purpose of analyzing bilateral monopoly. He let the abscissa represent the quantity of X_1 obtained by the individual, and the ordinate represent the quantity of X_2 given up.

It is evident that such indifference curves have a positive slope (if both commodities are desirable), for the individual will require more X_1 to offset (in utility) the loss of more X_2. In fact, the slope of the indifference curve with respect to the X_1 axis will be

$$\frac{dx_2}{dx_1} = \frac{MU_1}{MU_2}.$$ [92]

In addition, Edgeworth postulated that the indifference curves are concave to the X_1 axis.

Edgeworth's pioneer demonstration of the indeterminacy of bilateral monopoly will illustrate the advantage of this formulation.[93] A trader possessing X_2 but no X_1 would be at the origin; his indifference curves are those labeled I in Figure 3. The second trader, who

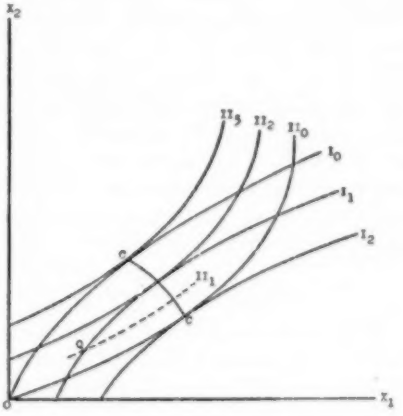

FIG. 3

possesses X_1 but no X_2, will have the corresponding indifference curves (II), for he will be giving up X_1 and acquiring X_2 in exchange. The points where the two sets of indifference curves are tangent form a curve, CC, which Edgeworth christened the contract curve. The ends of the contract curve are determined by the condition that no trader be worse off after trading than before, i.e., by the indifference curves, I_0 and II_0. The final contract between the traders must take place on this contract curve, because if it occurred elsewhere, it would be to the gain of one party, and not to the loss of the other, to move to the curve. Thus point Q was not a tenable point of final contract because individual II can move from

[91] The three commodity indifference surfaces are of course the limit of literal graphical exposition, and even they have been deemed unappetizingly complex.

[92] For $dx_1 MU_1$ will be the gain of utility from an increment dx_1, and $dx_2 MU_2$ will be the loss of utility from a decrement dx_2, and these must be equal if the movement is along an indifference curve.

[93] *Mathematical Psychics*, pp. 20 ff.

II_1 to the higher indifference curve II_2, while I remains on the same indifference curve, I_1. Any point on the contract curve is a position of possible equilibrium, and the precise position reached will be governed by "higgling dodges and designing obstinacy, and other incalculable and often disreputable accidents."[94]

Although this mode of exposition is convenient in the analysis of trade in two commodities between two individuals, it has no special advantage in the competitive case, and asymmetrical axes are awkward in algebraic analysis. Fisher introduced the now conventional graphical statement, in which the amounts held (or obtained) of the commodities appear on all axes.[95]

B. CONTEMPORARY PRACTICE

Despite the intuitive appeal of Edgeworth's generalized utility function, economists adhered to the additive utility function with considerable tenacity. In the nonmathematical writings, such as those of Böhm-Bawerk, Wieser, and J. B. Clark, the additive function was used almost exclusively. Barone defended it as an approximation.[96] Wicksell used it exclusively in his *Über Wert* (1894), although conceding the greater realism of the generalized function,[97] and found some place for it in his later *Lectures*.[98] Wicksteed used only the additive function in his *Alphabet* (1888)[99] and also in the elementary exposition of the theory in his *Common Sense* (1910) but not in the "advanced" statement.[100] Finally, Marshall and Pareto were so influential as to require more extended discussion.

Marshall also started with the Jevons-Walras assumption, to which he had probably arrived independently. This assumption was not explicit in the first edition of the *Principles* (1890), but one can cite evidence of its presence.

First, in his mathematical characterization of the utility function Marshall ignores any interdependence of utilities.[101] Second, he asserts the law of negatively sloping demand curves in all generality: "There is then one law and only one law which is common to all demand schedules, viz. that the greater the amount to be sold the smaller will be the price at which it will find purchasers."[102] This is a corollary of diminishing marginal utility only if the utility function is additive. Third, he was prepared to measure the utility of all commodities as the sum of the individual utilities: "We may regard the aggregate of the money measures of the total utility of wealth as a fair measure of that part of happiness which is dependent on wealth."[103]

In the second edition (1891) the as-

[94] *Ibid.*, p. 46.

[95] *Op. cit.*, Part II.

[96] *Le Opere economiche* (Bologna: Zanichelli, 1936), I, esp. pp. 22–23.

[97] *Über Wert, Kapital und Rente* (Jena: Fischer, 1894), esp. p. 43.

[98] *Lectures on Political Economy*, I, 46–47, 55 ff.; however, the generalized function is preferred (*ibid.*, pp. 41–42, 48–49, 79 ff).

[99] *Alphabet of Economic Science* (London: Macmillan, 1888).

[100] *Common Sense of Political Economy* (London: Routledge, 1934), Vol. I, chap. ii; Vol. II, chap. ii; the generalized function is used in Vol. II, chap. iii, esp. p. 479.

[101] *Principles of Economics* (London: Macmillan, 1890), Mathematical Notes II, III, VII [I, II, VI]. References in brackets will be used for corresponding passages in the eighth edition.

[102] *Ibid.*, pp. 159–60 [99].

[103] *Ibid.*, pp. 179–80, also Mathematical Note VII. His Mathematical Note III [II] also implies an additive function if his p, "the price which [a person] is just willing to pay for an amount [x] of the commodity . . ." is interpreted as our x_1p_1 and the price to the person is treated as constant. See Sec. VII.

sumption became reasonably explicit:

> Prof. Edgeworth's plan of representing U and V as general functions of x and y has great attractions to the mathematician; but it seems less adapted to express the everyday facts of economic life than that of regarding, as Jevons did, the marginal utilities of apples as functions of x simply.[104]

The facts both of everyday life and of contemporary theory soon led Marshall to make serious qualifications of his theory but never to qualify this statement.

Even in the first edition Marshall had inconsistently recognized the existence of "rival" products, which were defined as products able to satisfy the same desires.[105] Fisher's discussion of competing and completing goods seems to have been the stimulus to Marshall to give more weight to interrelationships of utilities in the third edition of the *Principles* (1895).[106] Once persuaded, Marshall modified his theory on two points. The first was that he slightly modified his assertion of the universality of negatively sloping demand curves and in fact introduced the Giffen paradox as an exception.[107] The second alteration was in his treatment of consumers' surplus: "When the total utilities of two commodities which contribute to the same purpose are calculated on this plan, we cannot say that the total utility of the two together is equal to the sum of the total utilities of each separately."[108] No important changes were made thereafter.

These alterations were only patchwork repairs; Marshall did not rework his theory of utility. He retained to the last a theory constructed on the assumption of an additive utility function.

Pareto also conceded the validity of the Edgeworth generalization but continued to use chiefly the additive function in his early work.[109] Indeed, he offered the remarkable argument:

> One sees now that instead of being able to use the indicated properties of the final degree of utility to demonstrate what laws demand and supply must obey, it is necessary to follow the opposite path, and use the knowledge of such laws one may obtain from experience to derive the properties of the final degree of utility. One cannot rigorously demonstrate the law of demand, but rather, from the directly observable fact that demand diminishes with the increase of price we deduce the consequence that the final degrees of utility may each be considered —as far as this phenomenon is concerned—as approximately dependent only on the quantity of the commodity to which it is related.[110]

In the *Manuel*, however, he showed that the additive utility function leads to conclusions which are contradicted by experience,[111] but defended it as an approximation which was permissible for large categories of expenditure and for small changes in the quantities of substitutes or complements.[112] There is no reason to believe that this is true.

[*To be concluded*]

[104] *Loc. cit.*, p. 756 [845]. See also the deduction of diminishing marginal utility from negatively sloping demand curves (*ibid.*, p. 159 [101 n.]).

[105] See Sec. VI.

[106] Reference is there made to Fisher's "brilliant" book, precisely on this point (*Principles* [3d ed.; London: Macmillan, 1895], p. 460 n. [390 n.]). For Fisher's discussion see Sec. VI below.

[107] *Loc. cit.*, p. 208 [132]. See my "Notes on the History of the Giffen Paradox," *Journal of Political Economy*, LV (1947), 152–56.

[108] He added the less than candid footnote: "Some ambiguous phrases in earlier editions appear to have suggested to some readers the opposite opinion" (*loc. cit.*, p. 207 and n. [131 and n.]).

[109] "Considerazioni sui principii fondamentali dell'economia politica pura," *Giornale degli economisti*, Series 2, Vol. V (August, 1892); *Cours d'économie politique* (Lausanne: Rouge, 1897), II, 332 ff.

[110] "Considerazioni . . . ," *op. cit.*, VII (1893), 307.

[111] Below, Sec. VII.

[112] *Manuel d'économie politique* (2d ed.; Paris: Giard, 1927), pp. 253 ff., 274.

A DIFFICULTY IN THE CONCEPT OF SOCIAL WELFARE

KENNETH J. ARROW[1]
Stanford University

I. INTRODUCTION

In a capitalist democracy there are essentially two methods by which social choices can be made: voting, typically used to make "political" decisions, and the market mechanism, typically used to make "economic" decisions. In the emerging democracies with mixed economic systems, Great Britain, France, and Scandinavia, the same two modes of making social choices prevail, though more scope is given to the method of voting and to decisions based directly or indirectly on it and less to the rule of the price mechanism. Elsewhere in the world, and even in smaller social units within the democracies, the social decisions are sometimes made by single individuals or small groups and sometimes (more and more rarely in this modern world) by a widely encompassing set of traditional rules for making the social choice in any given situation, e.g., a religious code.

The last two methods of social choice, dictatorship and convention, have in their formal structure a certain definiteness absent from voting or the market mechanism. In an ideal dictatorship, there is but one will involved in choice; in an ideal society ruled by convention, there is but the divine will or perhaps, by assumption, a common will of all individuals concerning social decisions, so that in either case no conflict of individual wills is involved. The methods of voting and of the market, on the other hand, are methods of amalgamating the tastes of many individuals in the making of social choices. The methods of dictatorship and convention are, or can be, rational in the sense that any individual can be rational in his choice. Can such consistency be attributed to collective modes of choice, where the wills of many people are involved?

It should be emphasized here that the present study is concerned only with the formal aspects of the foregoing question. That is, we ask if it is formally possible to construct a procedure for passing from a set of known individual tastes to a pattern of social decision-making, the procedure in question being required to satisfy certain natural conditions. An illustration of the problem is the following well-known "paradox of voting." Suppose there is a community consisting of three voters

[1] This paper is based on research carried on at the RAND Corporation, a project of the United States Air Force, and at the Cowles Commission for Research in Economics and is part of a longer study, "Social Choice and Individual Values," to be published by John Wiley & Sons as a Cowles Commission monograph. A version was read at the December, 1948, meeting of the Econometric Society. I am indebted to A. Kaplan, University of California at Los Angeles, and J. W. T. Youngs, University of Indiana, for guidance in formulating the problem, and to A. Bergson and A. G. Hart, Columbia University, and T. C. Koopmans, Cowles Commission and the University of Chicago, who have read the manuscript and made valuable comments on both the presentation and the meaning. Needless to say, any error or opacity remaining is the responsibility of the author.

and this community must choose among three alternative modes of social action (e.g., disarmament, cold war, or hot war). It is expected that choices of this type have to be made repeatedly, but sometimes not all of the three alternatives will be available. In analogy with the usual utility analysis of the individual consumer under conditions of constant wants and variable price-income situations, rational behavior on the part of the community would mean that the community orders the three alternatives according to its collective preferences once for all and then chooses in any given case that alternative among those actually available which stands highest on this list. A natural way of arriving at the collective preference scale would be to say that one alternative is preferred to another if a majority of the community prefer the first alternative to the second, i.e., would choose the first over the second if those were the only two alternatives. Let A, B, and C be the three alternatives, and 1, 2, and 3 the three individuals. Suppose individual 1 prefers A to B and B to C (and therefore A to C), individual 2 prefers B to C and C to A (and therefore B to A), and individual 3 prefers C to A and A to B (and therefore C to B). Then a majority prefers A to B, and a majority prefers B to C. We may therefore say that the community prefers A to B and B to C. If the community is to be regarded as behaving rationally, we are forced to say that A is preferred to C. But, in fact, a majority of the community prefers C to A.[2] So the method just outlined for passing from individual to collective tastes fails to satisfy the condition of rationality as we ordinarily understand it. Can we find other methods of aggregating individual tastes which imply rational behavior on the part of the community and which will be satisfactory in other ways?[3]

If we adopt the traditional identification of rationality with maximization of some sort, then the problem of achieving a social maximum derived from individual desires is precisely the problem which has been central to the field of welfare economics.[4] However, the search for a clear definition of optimum social welfare has been plagued by the difficulties of interpersonal comparisons. The emphasis, as is well known, has shifted to a weaker definition of optimum, namely, the determination of all social states such that no individual can be made better off without making someone worse off. As Professors Bergson, Lange, and Samuelson have argued, though, the weaker definition cannot be used as a guide to social policy; the second type of welfare economics is only important as a prelimi-

[2] It may be added that the method of decision sketched above is essentially that used in deliberative bodies, where a whole range of alternatives usually comes up for decision in the form of successive pairwise comparisons. The phenomenon described in the text can be seen in a pure form in the disposition of the proposals before recent Congresses for federal aid to state education, the three alternatives being no federal aid, federal aid to public schools only, and federal aid to both public and parochial schools.

[3] The problem of collective rationality has been discussed by Professor Frank H. Knight, but chiefly in terms of the socio-psychological prerequisites; see "The Planful Act: The Possibilities and Limitations of Collective Rationality," in *Freedom and Reform* (New York: Harper & Bros., 1947), pp. 335–69, esp. pp. 346–65).

[4] See P. A. Samuelson, *Foundations of Economic Analysis* (Cambridge, Mass.: Harvard University Press, 1947), chap. viii; A. Bergson (Burk), "A Reformulation of Certain Aspects of Welfare Economics," *Quarterly Journal of Economics*, LII (1938), 310–34; O. Lange, "The Foundations of Welfare Economics," *Econometrica*, X (1942), 215–28; M. W. Reder, *Studies in the Theory of Welfare Economics* (New York, 1947), chaps. i–v.

nary to the determination of a genuine social maximum in the full sense. E.g., under the usual assumptions, if there is an excise tax imposed on one commodity in the initial situation, it can be argued that the removal of the tax accompanied by a suitable redistribution of income and direct tax burdens will improve the position of all individuals in the society. But there are, in general, many redistributions which will accomplish this end, and society must have some criterion for choosing among them before it can make any change at all. Further, there is no reason for confining the range of possible social actions to those which will injure no one as compared with the initial situation, unless the status quo is to be sanctified on ethical grounds. All we can really say is that society ought to abolish the excise tax and make some redistribution of income and tax burdens; but this is no prescription for action unless there is some principle by which society can make its choice among attainable income distributions, i.e., a social indifference map.

Voting can be regarded as a method of arriving at social choices derived from the preferences of individuals. Another such method of more specifically economic content is the compensation principle, as proposed by Mr. Kaldor:[5] in a choice between two alternative economic states x and y, if there is a method of paying compensations under state x such that everybody can be made better off in the state resulting from making the compensations under x than they are in state y, then x should be chosen in preference to y, *even if the compensation is not actually paid.* Apart from the ethical difficulties in the acceptance of this principle,[6] there is a formal difficulty which was pointed out by Professor Scitovszky:[7] it is possible that simultaneously x should be preferred to y and y be preferred to x. Just as in the case of majority voting, this method of aggregating individual preferences may lead to a pattern of social choice which is not a linear ordering of the social alternatives. Note that in both cases the paradox need not occur; all that is said is that there are preference patterns which, if held by the individual members of the society, will give rise to an inconsistent pattern of social choice. Unless the trouble-breeding individual preference patterns can be ruled out by a priori assumption, both majority voting and the compensation principle must be regarded as unsatisfactory techniques for the determination of social preferences.

The aim of the present paper is to show that these difficulties are general. For *any* method of deriving social choices by aggregating individual preference patterns which satisfies certain natural conditions, it is possible to find individual preference patterns which give rise to a social choice pattern which is not a linear ordering. In particular, this is very likely to be the case if, as is frequently assumed, each individual's preferences among social states are derived purely from his personal consumption-leisure-saving situation in each.[8] It is assumed that individuals act rationally, in the sense that their be-

[5] N. Kaldor, "Welfare Propositions of Economics and Interpersonal Comparisons of Utility," *Economic Journal*, XLIX (1939), 549–652; see also J. R. Hicks, "The Foundations of Welfare Economics," *Economic Journal*, XLIX (1939), 698–701 and 711–12.

[6] See W. J. Baumol, "Community Indifference," *Review of Economic Studies*, XIV (1946–47), 44–48.

[7] T. Scitovszky, "A Note on Welfare Propositions in Economics," *Review of Economic Studies*, IX (1942), 77–88.

[8] See, e.g., Samuelson, *op. cit.*, pp. 222–24; Bergson, *op. cit.*, pp. 318–20; Lange, *op. cit.*, p. 216.

havior in alternative situations can be described by an indifference map. It is further assumed that utility is not measurable in any sense relevant to welfare economics, so that the tastes of an individual are completely described by a suitable preference pattern or indifference map.

II. DEFINITIONS AND NOTATION

1. A NOTATION FOR PREFERENCES AND CHOICE

In this paper I shall be interested in the description of preference patterns both for the individual and for society. It will be found convenient to represent preference by a notation not customarily employed in economics, though familiar in mathematics and particularly in symbolic logic. We assume that there is a basic set of alternatives which could conceivably be presented to the chooser. In the theory of consumers' choice, each alternative would be a commodity bundle; in the theory of the firm, each alternative would be a complete decision on all inputs and outputs; in welfare economics, each alternative would be a distribution of commodities and labor requirements. These alternatives are mutually exclusive; they are denoted by small letters, $x, y, z, \ldots$. On any given occasion the chooser has available to him a subset S of all possible alternatives, and he is required to choose one out of this set. The set S is a generalization of the well-known opportunity curve; thus, in the theory of consumer's choice under perfect competition, it would be the budget plane. It is assumed further that the choice is made in this way: Before knowing the set S, the chooser considers in turn all possible pairs of alternatives, say x and y, and for each pair he makes one and only one of three decisions: x is preferred to y, x is indifferent to y, or y is preferred to x. The decisions made for different pairs are assumed to be consistent with one another, so that, for example, if x is preferred to y and y to z, then x is preferred to z; similarly, if x is indifferent to y and y to z, then x is indifferent to z. Having this ordering of all possible alternatives, the chooser is now confronted with a particular opportunity set S. If there is one alternative in S which is preferred to all others in S, then the chooser selects that one alternative.[9]

Preference and indifference are relations between alternatives. Instead of working with two relations, it will be slightly more convenient to use a single relation, "preferred or indifferent." The statement, "x is preferred or indifferent to y," will be symbolized by xRy. The letter R, by itself, will be the name of the relation and will stand for a knowledge of all pairs such that xRy. From our previous discussion, we have, for any pair of alternatives x and y, either that x is preferred to y or y to x or that the two are indifferent. That is, we have assumed that any two alternatives are comparable. But this assumption may be written symbolically,

Axiom I: For all x and y, either xRy or yRx.

Note that Axiom I is presumed to hold when $x = y$, as well as when x is distinct from y, for we ordinarily say that x is indifferent to itself for any x, and this implies xRx. Note also that the

[9] It may be that there is a subset of alternatives in S, such that the alternatives in the subset are each preferred to every alternative not in the subset, while the alternatives in the subset are indifferent to one another. This case would be one in which the highest indifference curve which has a point in common with a given opportunity curve has at least two points in common with it (the well-known case of multiple maxima). In this case, the best thing to say is that the choice made in S is the whole subset; the first case discussed is one in which the subset in question, the choice, contains a single element.

word "or" in the statement of Axiom I does not exclude the possibility of both xRy and yRx. That word merely asserts that at least one of the two events must occur; both may.

The property mentioned above of consistency in the preferences as between different pairs of alternatives may be stated more precisely, as follows: if x is preferred or indifferent to y and y is preferred or indifferent to z, then x must be either preferred or indifferent to z. In symbols,

Axiom II: For all x, y, and z, xRy and yRz imply xRz.

A relation satisfying both Axiom I and Axiom II is termed a weak ordering or sometimes simply an ordering. It is clear that a relation having these two properties taken together does create a ranking of the various alternatives. The adjective "weak" refers to the fact that the ordering does not exclude indifference, i.e., Axioms I and II do not exclude the possibility that for some distinct x and y, both xRy and yRx.

It might be held that the two axioms in question do not completely characterize the concept of a preference pattern. For example, we ordinarily feel that not only the relation R but also the relations of (strict) preference and of indifference satisfy Axiom II. It can be shown that, by defining preference and indifference suitably in terms of R, it will follow that all the usually desired properties of preference patterns obtain.

Definition 1: xPy is defined to mean not yRx.

The statement "xPy" is read, "x is preferred to y."

Definition 2: xIy means xRy and yRx.

The statement "xIy" is read, "x is indifferent to y." It is clear that P and I, so defined, correspond to the ordinary notions of preference and indifference, respectively.

Lemma: *a*) For all x, xRx.
b) If xPy, then xRy.
c) If xPy and yPz, then xPz.
d) If xIy and yIz, then xIz.
e) For all x and y, either xRy or yPx.
f) If xPy and yRz, then xPz.

All these statements are intuitively self-evident from the interpretations placed on the symbols.

For clarity, we shall avoid the use of the terms "preference scale" or "preference pattern" when referring to R, since we wish to avoid confusion with the concept of preference proper, denoted by P. We shall refer to R as an "ordering relation" or "weak ordering relation" or, more simply, as an "ordering" or "weak ordering." The term "preference relation" will refer to the relation P.

Suppose that we know the choice which would be made from any given pair of alternatives; i.e., given two alternatives x and y from which the chooser must select, we know whether he would take x or y or remain indifferent between them. Since choosing x from the pair x, y implies that x is preferred to y, and similarly with a choice of y, a knowledge of the choice which would be made from any two given alternatives implies a knowledge of the full preference scale; from earlier remarks this, in turn, implies a knowledge of the choice which would be made from any set of alternatives actually available. Hence, one of the consequences of the assumption of rational behavior is that the choice from any collection of alternatives can be determined by a knowledge of the choices

which would be made from pairs of alternatives.

2. THE ORDERING OF SOCIAL STATES

In the present study the objects of choice are social states. The most precise definition of a social state would be a complete description of the amount of each type of commodity in the hands of each individual, the amount of labor to be applied by each individual, the amount of each productive resource invested in each type of productive activity, and the amounts of various types of collective activity such as municipal services, diplomacy and its continuation by other means, and the erection of statues to famous men. It is assumed that each individual in the community has a definite ordering of all conceivable social states in terms of their desirability to him. It need not be assumed here that an individual's attitude toward different social states is determined exclusively by the commodity bundles which accrue to his lot under each. The individual may order all social states by whatever standards he deems relevant. A member of Veblen's leisure class might order the states solely on the criterion of his relative income standing in each; a believer in the equality of man might order them in accordance with some measure of income equality. Indeed, since, as mentioned above, some of the components of the social state, considered as a vector, are collective activities, purely individualistic assumptions are useless in analyzing such problems as the division of the national income between public and private expenditure. The present notation permits perfect generality in this respect. Needless to say, this generality is not without its price. More information would be available for analysis if the generality were restricted by a prior knowledge of the nature of individual orderings of social states. This problem will be touched on again.

In general, then, there will be a difference between the ordering of social states according to the direct consumption of the individual and the ordering when the individual adds his general standards of equity (or perhaps his standards of pecuniary emulation).[10] We may refer to the former ordering as reflecting the *tastes* of the individual and the latter as reflecting his *values*. The distinction between the two is by no means clear cut. An individual with aesthetic feelings certainly derives pleasure from his neighbor's having a well-tended lawn. Under the system of a free market, such feelings play no direct part in social choice; yet, psychologically, they differ only slightly from the pleasure in one's own lawn. Intuitively, of course, we feel that not all the possible preferences which an individual might have ought to count; his preferences for matters which are "none of his business" should be irrelevant. Without challenging this view, I should like to emphasize that the decision as to which preferences are relevant and which are not is itself a value judgment and cannot be settled on an a priori basis. From a formal point of view, one cannot distinguish between an individual's dislike of having his grounds ruined by factory smoke and his extreme distaste for the existence of heathenism in Central Africa. There are probably not a few individuals in this country who would regard the former feeling as irrelevant for social policy and the latter as relevant, though

[10] This distinction has been stressed to the author by M. Friedman, University of Chicago.

the majority would probably reverse the judgment. I merely wish to emphasize here that we must look at the entire system of values, including values about values, in seeking for a truly general theory of social welfare.

It is the ordering according to values which takes into account all the desires of the individual, including the highly important socializing desires, and which is primarily relevant for the achievement of a social maximum. The market mechanism, however, takes into account only the ordering according to tastes. This distinction is the analogue, on the side of consumption, of the divergence between social and private costs in production which has been developed by Professor Pigou.[11]

As for notation, let R_i be the ordering relation for alternative social states from the standpoint of individual i. Sometimes, when several different ordering relations are being considered for the same individual, the symbols will be distinguished by adding a superscript. Corresponding to the ordering relation R_i, we have the (strict) preference relation P_i and the indifference relation I_i. If the symbol for the ordering has a prime or second attached (thus, R_i', R_i''), then the corresponding symbols for preference and indifference will have the prime or second attached, respectively.

Similarly, society as a whole will be considered provisionally to have a social ordering relation for alternative social states, which will be designated by R, sometimes with a prime or second. Social preference and indifference will be denoted by P and I, respectively, primes or seconds being attached when they are attached to the relation R, respectively.

Throughout this analysis, it will be assumed that individuals are rational, by which is meant that the ordering relations R_i satisfy Axioms I and II. The problem will be to construct an ordering relation for society as a whole which is also to reflect rational choice-making, so that R also will be assumed to satisfy Axioms I and II.

III. THE SOCIAL WELFARE FUNCTION

1. FORMAL STATEMENT OF THE PROBLEM OF SOCIAL CHOICE

I shall largely restate Bergson's formulation of the problem of making welfare judgments[12] in the terminology here adopted. The various arguments of his social welfare function are the components of what I have here termed the "social state," so that essentially he is describing the process of assigning a numerical social utility to each social state, the aim of society then being described by saying it seeks to maximize the social utility or social welfare subject to whatever technological or resource constraints are relevant, or, put otherwise, it chooses the social state yielding the highest possible social welfare within the environment. As with any type of behavior described by maximization, the measurability of social welfare need not be assumed; all that matters is the existence of a social ordering satisfying Axioms I and II. As before, all that is needed to define such an ordering is to know the relative ranking of each pair of alternatives.

The relative ranking of a fixed pair

[11] A. C. Pigou, *The Economics of Welfare* (London: Macmillan & Co., 1920), Part II, chap. vi. For the analogy see Samuelson, *op. cit.*, p. 224; Reder, *op. cit.*, pp. 64–67; G. Tintner, "A Note on Welfare Economics," *Econometrica*, XIV (1946), 69–78.

[12] Bergson, *op. cit.*

of alternative social states will vary, in general, with changes in the values of at least some individuals; to assume that the ranking does not change with any changes in individual values is to assume, with traditional social philosophy of the Platonic realist variety, that there exists an objective social good defined independently of individual desires. This social good, it was frequently held, could be best apprehended by the methods of philosophic inquiry. Such a philosophy could be and was used to justify government by elite, secular or religious, although the connection is not a necessary one.

To the nominalist temperament of the modern period the assumption of the existence of the social ideal in some Platonic realm of being was meaningless. The utilitarian philosophy of Jeremy Bentham and his followers sought instead to ground the social good on the good of individuals. The hedonist psychology associated with utilitarian philosophy was further used to imply that each individual's good was identical with his desires. Hence, the social good was in some sense to be a composite of the desires of individuals. A viewpoint of this type serves as a justification of both political democracy and laissez faire economics or at least an economic system involving free choice of goods by consumers and of occupations by workers.

The hedonist psychology finds its expression here in the assumption that individuals' behavior is expressed by individual ordering relations R_i. Utilitarian philosophy is expressed by saying for each pair of social states that the choice depends on the ordering relations of all individuals, i.e., depends on $R_1, \ldots, R_n$, where n is the number of individuals in the community. Put otherwise, the whole social ordering relation R is to be determined by the individual ordering relations for social states, $R_1, \ldots, R_n$. We do not exclude here the possibility that some or all of the choices between pairs of social states made by society might be independent of the preferences of certain particular individuals, just as a function of several variables might be independent of some of them.

Definition 3: By a "social welfare function" will be meant a process or rule which, for each set of individual orderings $R_1, \ldots, R_n$ for alternative social states (one ordering for each individual), states a corresponding social ordering of alternative social states, R.

As a matter of notation, we shall let R be the social ordering corresponding to the set of individual orderings $R_1, \ldots, R_n$, the correspondence being that established by a given social welfare function; if primes or seconds are added to the symbols for the individual orderings, primes or seconds will be added to the symbol for the corresponding social ordering.

There is some difference between the concept of social welfare function used here and that employed by Bergson. The individual orderings which enter as arguments into the social welfare function as defined here refer to the values of individuals rather than to their tastes. Bergson supposes individual values to be such as to yield a social value judgment leading to a particular rule for determining the allocation of productive resources and the distribution of leisure and final products in accordance with individual tastes. In effect, the social welfare function described here is a method of choosing which social welfare function of the Bergson type will be applicable, though of course I do not ex-

clude the possibility that the social choice actually arrived at will not be consistent with the particular value judgments formulated by Bergson. But in the formal aspect the difference between the two definitions of social welfare function is not too important. In Bergson's treatment the tastes of individuals (each for his own consumption) are represented by utility functions, i.e., essentially by ordering relations; hence, the Bergson social welfare function is also a rule for assigning to each set of individual orderings a social ordering of social states. Further, as already indicated, no sharp line can be drawn between tastes and values.

A special type of social welfare function would be one which assigns the same social ordering for every set of individual orderings. In this case, of course, social choices are completely independent of individual tastes, and we are back in the Platonic case.

For simplicity of exposition, it will be assumed that the society under study contains only two individuals and that the total number of alternatives which are conceivable is three. Since the results to be obtained are negative, the latter restriction is not a real one; if it turns out to be impossible to construct a social welfare function which will define a social ordering of three alternatives, it will a fortiori be impossible to define one which will order more alternatives. The restriction to two individuals may be more serious; it is conceivable that there may be suitable social welfare functions which can be defined for three individuals but not for two, for example. In fact, this is not so, and the results stated in this paper hold for any number of individuals. However, the proof will be considerably simplified by considering only two.

We shall not ask, in general, that the social welfare function be defined for every logically possible set of individual orderings. On a priori grounds we may suppose it known that preferences for alternative social states are formed only in a limited set of ways, and the social welfare function need only be defined for individual orderings formed in those ways. For example, we may suppose (and will later on) that each individual orders social alternatives according to his own personal consumption under each (the purely individualistic case). Then the social welfare function need be defined only for those sets of individual orderings which are admissible, in the sense of being consistent with our a priori assumptions about the empirical possibilities.

Condition 1: The social welfare function is defined for every admissible pair of individual orderings, R_1, R_2.

Condition 1, it should be emphasized, is a restriction on the form of the social welfare function, since we are requiring that for some sufficiently wide range of sets of individual orderings, the social welfare function give rise to a true social ordering.

2. POSITIVE ASSOCIATION OF SOCIAL AND INDIVIDUAL VALUES

Since we are trying to describe social "welfare" and not some sort of "illfare," we must assume that the social welfare function is such that the social ordering responds positively to alterations in individual values or at least not negatively. Hence, we may state the following condition:

Condition 2: If an alternative social state x rises or does not fall in the ordering of each

individual without any other change in those orderings and if x was preferred to another alternative y before the change in individual orderings, then x is still preferred to y.

3. THE INDEPENDENCE OF IRRELEVANT ALTERNATIVES

Just as for a single individual, the choice made by society from any given set of alternatives should be independent of the very existence of alternatives outside the given set. For example, suppose an election system has been devised whereby each individual lists all the candidates in order of his preference, and then, by a preassigned procedure, the winning candidate is derived from these lists. (All actual election procedures are of this type, although in most the entire list is not required for the choice.) Suppose an election is held, with a certain number of candidates in the field, each individual filing his list of preferences, and then one of the candidates dies. Surely, the social choice should be made by taking each of the individual's preference lists, blotting out completely the dead candidate's name, and considering only the orderings of the remaining names in going through the procedure of determining the winner. That is, the choice to be made among the set of surviving candidates should be independent of the preferences of individuals for the nonsurviving candidates. To assume otherwise would be to make the result of the election dependent on the obviously accidental circumstance of whether a candidate died before or after the date of polling. Therefore, we may require of our social welfare function that the choice made by society from a given set of alternatives depend only on the orderings of individuals among those alternatives. Alternatively stated, if we consider two sets of individual orderings such that, for each individual, his ordering of those particular alternatives under consideration is the same each time, then we require that the choice made by society be the same if individual values are given by the first set of orderings as if they are given by the second.

Condition 3: Let R_1, R_2, and R_1', R_2' be two sets of individual orderings. If, for both individuals i and for all x and y in a given set of alternatives S, xR_iy if and only if $xR_i'y$, then the social choice made from S is the same whether the individual orderings are R_1, R_2, or R_1', R_2'. (Independence of irrelevant alternatives.)

The reasonableness of this condition can be seen by consideration of the possible results in a method of choice which does not satisfy Condition 3, the rank-order method of voting frequently used in clubs.[13] With a finite number of candidates, let each individual rank all his candidates, i.e., designate his first-choice candidate, second-choice candidate, etc. Let preassigned weights be given first, second, etc., choices, the higher weight to the higher choice, and then let the candidate with the highest weighted sum of votes be elected. In particular, suppose there are three voters and four candidates, x, y, z, and w. Let the weights for first, second, third, and fourth choices be 4, 3, 2, and 1, respectively. Suppose that individuals 1 and 2 rank the candidates in the order x, y, z, and w, while individual 3 ranks them in the order z, w, x, and y. Under the given electoral system, x is chosen. Then, certainly, if y is deleted from the ranks of the candidates, the system applied to the remaining candidates should yield the same result,

[13] This example was suggested by a discussion with G. E. Forsythe, National Bureau of Standards.

especially since, in this case, y is inferior to x according to the tastes of every individual; but, if y is in fact deleted, the indicated electoral system would yield a tie between x and z.

The condition of the independence of irrelevant alternatives implies that in a generalized sense all methods of social choice are of the type of voting. If S is the set consisting of the two alternatives x and y, Condition 3 tells us that the choice between x and y is determined solely by the preferences of the members of the community as between x and y. That is, if we know which members of the community prefer x to y, which are indifferent, and which prefer y to x, then we know what choice the community makes. Knowing the social choices made in pairwise comparisons in turn determines the entire social ordering and therewith the social choice made from any set of alternatives. Condition 2 guarantees that voting for a certain alternative has the usual effect of making surer that that alternative will be adopted.

Condition 1 says, in effect, that, as the set of alternatives varies and individual orderings remain fixed, the different choices made shall bear a certain type of consistent relation to one another. Conditions 2 and 3, on the other hand, suppose a fixed set of alternatives and say that for certain particular types of variation in individual values, the various choices made have a certain type of consistency.

4. THE CONDITION OF CITIZENS' SOVEREIGNTY

We certainly wish to assume that the individuals in our society be free to choose, by varying their values, among the alternatives available. That is, we do not wish our social welfare function to be such as to prevent us, by its very definition, from expressing a preference for some given alternative over another.

Definition 4: A social welfare function will be said to be *imposed* if for some pair of distinct alternatives x and y, xRy for any set of individual orderings R_1, R_2, where R is the social ordering corresponding to R_1, R_2.

In other words, when the social welfare function is imposed, there is some pair of alternatives x and y such that the community can never express a preference for y over x no matter what the tastes of both individuals are, indeed even if both individuals prefer y to x; some preferences are taboo. (Note that, by Definition 1, asserting that xRy holds for all sets of individual orderings is equivalent to asserting that yPx never holds.) We certainly wish to require of our social welfare function the condition that it not be imposed in the sense of Definition 4; we certainly wish all choices to be possible if unanimously desired by the group.

Condition 4: The social welfare function is not to be imposed.

Condition 4 is stronger than need be for the present argument. Some decisions, as between given pairs of alternatives, may be assumed to be imposed. All that is required really is that there be a set S of three alternatives such that the choice between any pair is not constrained in advance by the social welfare function.

It should also be noted that Condition 4 excludes the Platonic case discussed in section 1 of Part III above. It expresses fully the idea that all social choices are determined by individual desires. In conjunction with Condition 2 (which insures that the determination is in the direction of agreeing with individual desires), Condition 4

expresses the same idea as Professor Bergson's Fundamental Value Propositions of Individual Preference, which state that of two alternatives between which all individuals but one are indifferent, the community will prefer one over the other or be indifferent between the two according as the one individual prefers one over the other or is indifferent between the two.[14] Conditions 2 and 4 together correspond to the usual concept of consumers' sovereignty; since we are here referring to values rather than to tastes, we might refer to them as expressing the idea of citizens' sovereignty.

5. THE CONDITION OF NONDICTATORSHIP

A second form of social choice not of a collective character is the choice by dictatorship. In its pure form this means that social choices are to be based solely on the preferences of one man. That is, whenever the dictator prefers x to y, so does society. If the dictator is indifferent between x and y, presumably he will then leave the choice up to some or all of the other members of society.

Definition 5: A social welfare function is said to be "dictatorial" if there exists an individual i such that for all x and y, xP_iy implies xPy regardless of the orderings of all individuals other than i, where P is the social preference relation corresponding to those orderings.

Since we are interested in the construction of collective methods of social choice, we wish to exclude dictatorial social welfare functions.

[14] Bergson, *op. cit.*, pp. 318–20. The Fundamental Value Propositions of Individual Preference are not, strictly speaking, implied by Conditions 2 and 4 (in conjunction with Conditions 1 and 2), although something very similar to them is so implied; see Consequence 1 in Part IV, section 2 below. A slightly stronger form of Condition 2 than that stated here would suffice to yield the desired implication.

Condition 5: The social welfare function is not to be dictatorial (nondictatorship).

We have now imposed five apparently reasonable conditions on the construction of a social welfare function. These conditions are of course value judgments and could be called into question; taken together, they express the doctrines of citizens' sovereignty and rationality in a very general form, with the citizens being allowed to have a wide range of values. The question is that of constructing a social ordering of all conceivable alternative social states from any given set of individual orderings of those social states, the method of construction being in accordance with the value judgments of citizens' sovereignty and rationality as expressed in Conditions 1–5.

IV. THE POSSIBILITY THEOREM FOR SOCIAL WELFARE FUNCTIONS

1. THE RANGE OF POSSIBLE INDIVIDUAL ORDERINGS

For simplicity we shall impose on the individual preference scales two conditions which in fact have almost invariably been assumed in works on welfare economics: (1) each individual's comparison of two alternative social states depends only on the commodities that he receives (and labor that he expends) in the two states, i.e., he is indifferent as between any two social states in which his own consumption-leisure-saving situations are the same or at least indifferent to him; (2) in comparing two personal situations in one of which he receives at least as much of each commodity (including leisure and saving as commodities) and more of at least one commodity than in the other, the individual will prefer the first situation. Suppose that among the possible alternatives

there were three, none of which gave any individual at least as much of both commodities as any other. For example, suppose that there are two individuals and a total of ten units of each of two commodities. Consider three alternative distributions described by the accompanying tabulation. The individualistic

Alternative	Individual 1		Individual 2	
	Commodity 1	Commodity 2	Commodity 1	Commodity 2
1	5	1	5	9
2	4	2	6	8
3	3	3	7	7

restrictions imposed do not tell us anything about the way either individual orders these alternatives. Under the individualistic assumptions there is no a priori reason to suppose that the two individuals will not order the alternatives in any given way. In the sense of Part III, section 1, above, all individual orderings of the three alternatives are admissible. Condition 1 therefore requires that the social welfare function be defined for all pairs of individual orderings, R_1, R_2.

2. THE POSSIBILITY THEOREM

Some consequences will be drawn from Conditions 1–5 for the present case of a social welfare function for two individuals and three alternatives. It will be shown that the supposition that there is a social welfare function satisfying those conditions leads to a contradiction.

Let x, y, and z be the three alternatives among which choice is to be made, e.g., three possible distributions of commodities. Let x' and y' be variable symbols which represent possible alternatives, i.e., range over the values x, y, z. Let the individuals be designated as 1 and 2, and let R_1 and R_2 be the orderings by 1 and 2, respectively, of the alternatives x, y, z. Let P_1 and P_2 be the corresponding preference relations; e.g., $x'P_1y'$ means that individual 1 strictly prefers x' to y'.

Consequence 1: If $x'P_1y'$ and $x'P_2y'$, then $x'Py'$.

I.e., if both prefer x' to y', then society must prefer x' to y'.

Proof.—By Condition 4 there are orderings R_1' and R_2', for individuals 1 and 2, respectively, such that, in the corresponding social preference, $x'P'y'$. Form R_1'' from R_1' by raising x', if need be, to the top, while leaving the relative positions of the other two alternatives alone; form R_2'' from R_2' in the same way. Since all we have done is raise alternative x' in everyone's esteem, while leaving the others alone, x' should still be preferred to y' by society in accordance with Condition 2, so that $x'P''y'$. But, by construction, both individuals prefer x' to y' in the orderings R_1'', R_2'', and society prefers x' to y'. Since, by Condition 3, the social choice between x' and y' depends only on the individual orderings of those two alternatives, it follows that whenever both individuals prefer x' to y', regardless of the rank of the third alternative, society will prefer x' to y', which is the statement to be proved.

Consequence 2: Suppose that for some x' and y', whenever $x'P_1y'$ and $y'P_2x'$, $x'Py'$. Then, for that x' and y', whenever $x'P_1y'$, $x'Py'$.

I.e., if in a given choice, the will of individual 1 prevails against the opposition of 2, then individual 1's views will certainly prevail if 2 is indifferent or if he agrees with 1.

Proof.– Let R_1 be an ordering in which $x'P_1y$, R_2 be any ordering. Let

R_1' be the same ordering as R_1, while R_2' is derived from R_2 by depressing x' to the bottom while leaving the relative positions of the other two alternatives unchanged. By construction, $x'P_1'y'$, $y'P_2'x'$. By hypothesis, $x'P'y'$, where P' is the social preference relation derived from the individual orderings R_1', R_2'. Now the only difference between R_1', R_2' and R_1, R_2 is that x' is raised in the scale of individual 2 in the latter as compared with the former. Hence, by Condition 2 (interchanging the R_i's and the R_i''s) it follows from $x'P'y'$ that $x'Py'$. I.e., whenever R_1, R_2 are such that $x'P_1y'$, then $x'Py'$.

Consequence 3: If $x'P_1y'$ and $y'P_2x'$, then $x'Iy'$.

I.e., if the two individuals have exactly opposing interests on the choice between two given alternatives, then society will be indifferent between the alternatives.

PROOF.—Suppose the consequence is false. Then, for some orderings R_1 and R_2 and for some pair of alternatives x' and y', we would have $x'P_1y'$, $y'P_2x'$, but not $x'Iy'$. In that case, either $x'Py'$ or $y'Px'$. We will suppose $x'Py'$ and show that this supposition leads to a contradiction; the same reasoning would show that the assumption $y'Px'$ also leads to a contradiction.

Without loss of generality it can be assumed that x' is the alternative x, $y' = y$. Then we have, for the particular orderings in question, xP_1y, yP_2x, and xPy. Since the social choice between x and y depends, by Condition 3, only on the individual choices as between x and y, we must have

$$\text{whenever } xP_1y \text{ and } yP_2x, xPy. \qquad (1)$$

It will be shown that (1) leads to a contradiction.

Suppose individual 1 prefers x to y and y to z, while individual 2 prefers y to z and z to x. Individual 2 then prefers y to x. By (1) society prefers x to y. Also, both prefer y to z; by Consequence 1, society prefers y to z. Since society prefers x to y and y to z, it must prefer x to z. Therefore, we have exhibited orderings R_1, R_2 such that xP_1z, zP_2x, but xPz. Since the social choice between x and z depends only on the individual preferences for x and z,

$$\text{whenever } xP_1z \text{ and } zP_2x, xPz. \qquad (2)$$

Now suppose R_1 is the ordering y, x, z, and R_2 the ordering z, y, x. By Consequence 1, yPx; by (2) xPz, so that yPz. By the same reasoning as before,

$$\text{whenever } yP_1z \text{ and } zP_2y, yPz. \qquad (3)$$

If R_1 is the ordering y, z, x, and R_2 the ordering z, x, y, it follows from Consequence 1 and (3) that zPx and yPz, so that yPx. Hence,

$$\text{whenever } yP_1x \text{ and } xP_2y, yPx. \qquad (4)$$

If R_1 is the ordering z, y, x, and R_2 the ordering x, z, y, then from Consequence 1 and (4), zPy and yPx, so that zPx.

$$\text{Whenever } zP_1x \text{ and } xP_2z, zPx. \qquad (5)$$

If R_1 is the ordering z, x, y, and R_2 x, y, z, then, using (5), zPx and xPy, so that zPy.

$$\text{Whenever } zP_1y \text{ and } yP_2z, zPy. \qquad (6)$$

From (1) it follows from Consequence 2 that whenever xP_1y, xPy. Similarly, from (1) to (6) it follows that for any pair of alternatives x', y', whenever $x'P_1y'$, then $x'Py'$. That is, by Definition 5, individual 1 would be a dictator. This is prohibited by Condition 5, so that (1) must be false. Therefore, Consequence 3 is proved.

Now suppose individual 1 has the ordering x, y, z, while individual 2 has the ordering z, x, y. By Consequence 1,

$$xPy. \tag{7}$$

Since yP_1z, zP_2y, it follows from Consequence 3 that

$$yIz. \tag{8}$$

From (7) and (8), xPz. But, also xP_1z, zP_2x, which implies xIz by Consequence 3. It cannot be that x is both preferred and indifferent to z. Hence the assumption that there is a social welfare function compatible with Conditions 1–5 has led to a contradiction.

Put another way, if we assume that our social welfare function satisfies Conditions 2–3 and we further suppose that Condition 1 holds, then either Condition 4 or Condition 5 must be violated. Condition 4 states that the social welfare function is not imposed; Condition 5 states that it is not dictatorial.

Possibility Theorem.—If there are at least three alternatives among which the members of the society are free to order in any way, then every social welfare function satisfying Conditions 2 and 3 and yielding a social ordering satisfying Axioms I and II must be either imposed or dictatorial.[15] The Possibility Theorem shows that, if no prior assumptions are made about the nature of individual orderings, there is no method of voting which will remove the paradox of voting discussed in Part I, neither plurality voting nor any scheme of proportional representation, no matter how complicated. Similarly, the market mechanism does not create a rational social choice.

[15] The negative outcome expressed in this theorem is strongly reminiscent of the intransitivity of the concept of domination in the theory of multiperson games; see John von Neumann and Oskar Morgenstern. *Theory of Games and Economic Behavior* (2d ed.; Princeton University Press, 1947), pp. 38–39.

V. SOME IMPLICATIONS FOR THE FORMATION OF SOCIAL WELFARE JUDGMENTS

1. INTERPRETATION OF THE POSSIBILITY THEOREM

The interpretation of the Possibility Theorem is given by examination of the meaning of Conditions 1–5. In particular, it is required that the social ordering be formed from individual orderings and that the social decision between two alternatives be independent of the desires of individuals involving any alternatives other than the given two (Conditions 1 and 3). These conditions taken together serve to exclude interpersonal comparison of social utility either by some form of direct measurement or by comparison with other alternative social states. Therefore, the Possibility Theorem can be restated as follows:

If we exclude the possibility of interpersonal comparisons of utility, then the only methods of passing from individual tastes to social preferences which will be satisfactory and which will be defined for a wide range of sets of individual orderings are either imposed or dictatorial.

The word "satisfactory" in the foregoing statement means that the social welfare function does not reflect individuals' desires negatively (Condition 2) and that the resultant social tastes shall be represented by an ordering having the usual properties of rationality ascribed to individual orderings (Condition 1 and Axioms I and II).

In view of the interpretations placed on the conditions for a social welfare function in Part III above, we can also phrase the result this way: If con-

sumers' values can be represented by a wide range of individual orderings, the doctrine of voters' sovereignty is incompatible with that of collective rationality.

If we wish to make social welfare judgments which depend on all individual values, i.e., are not imposed or dictatorial, then we must relax some of the conditions imposed. It will continue to be maintained that there is no meaningful interpersonal comparison of utilities and that the conditions wrapped up in the word "satisfactory" are to be accepted.[16] The only condition that remains to be eliminated is the one stating that the method of forming a social ordering would work properly for a wide range of sets of individual orderings. That is, it must be supposed that it is known in advance that the individual orderings $R_1, \ldots, R_n$ for social actions satisfy certain conditions more restrictive than those hitherto introduced.

2. A REFLECTION ON THE NEW WELFARE ECONOMICS

As noted in Part I, the so-called "new welfare economics" has concentrated on the determination of the totality of social states which have the property that any change which benefits one individual injures another—"maximal states" in Lange's terminology. In particular, this problem has usually been analyzed under the assumption that individual desires for social alternatives are formed in the individualistic way described above in Part IV, section 1. But if the only restrictions that we wish to impose on individual tastes are those implied by the individualistic assumptions, then, as we have seen, there is no satisfactory social welfare function possible when there is more than one commodity. Since, as we have seen, the only purpose of the determination of the maximal states is as a preliminary to the study of social welfare functions, the customary study of maximal states under individualistic assumptions is pointless. There is, however, a qualification which should be added. It is conceivable that, if further restrictions are added to the individualistic ones, a social welfare function will be possible. Any state which is maximal under the combination of individualistic and other restrictions will certainly be maximal if only individualistic restrictions are imposed on the individual orderings. Hence, if the proper handling of the social welfare problem is deemed to be the imposition of further restrictions in addition to the individualistic ones, then the social maximum in any given situation will be one of the maximal elements under the combined restrictions and hence one of the maximal elements under individualistic conditions. It is therefore not excluded that the current new welfare economics will be of some use in restricting the range in which we must look for the social maximum.

The failure of purely individualistic assumptions to lead to a well-defined social welfare function means, in effect, that there must be a divergence between social and private benefits if we are to be able to discuss a social optimum. Part of each individual's value system must be a scheme of socio-ethical norms, the realization of which cannot, by their nature, be achieved through atomistic market behavior. These norms, further, must be suffi-

[16] The only part of the last-named conditions that seems to me to be at all in dispute is the assumption of rationality. The consequences of dropping this assumption are so radical that it seems worth while to explore the consequences of maintaining it.

ciently similar among the members of the society to avoid the difficulties outlined above.

3. A ONE-COMMODITY WORLD

The insufficiency of the individualistic hypotheses to permit the formation of a social welfare function, as developed in the previous sections, hinged on the assumption that there was more than one commodity involved. An investigation of the one-commodity case may be of interest to bring out more clearly the issues involved.

In a one-commodity world, if we make assumptions 1 and 2 of Part IV, section 1, there is for any given individual only one possible ordering of the social states. He orders various social states solely according to the amount of the one commodity he gets under each. In such a situation the individual orderings are not variables; Conditions 2, 3, and 4 become irrelevant, since they relate to the variation in the social ordering corresponding to certain specified types of changes in the individual orderings. Condition 5 (nondictatorship) becomes a much weaker restriction, though not completely irrelevant. Any specification of a social ordering which does not coincide completely with the ordering of any one individual will be a social welfare function compatible with all the conditions. For example, for each fixed total output, we might set up arbitrarily an ordering of the various distributions; then order any two social states with different total outputs in accordance with the total output, any two social states with the same total output according to the arbitrary ordering. This sets up a genuine weak ordering which does not coincide with the ordering of any one individual. For let x and y be two states with total outputs s and t, respectively, and apportionments s' and t', respectively, to the given individual. If $s > t$, but $s' < t'$, then society prefers x to y, while the individual prefers y to x.

The qualitative nature of the difference between the single- and multicommodity cases makes any welfare arguments based on an implicit assumption of a single commodity dubious in its applicability to real situations. The fundamental difficulty is that, in a world of more than one commodity, there is no unequivocal meaning to comparing total production in any two social states save in terms of some standard of value to make the different commodities commensurable; and, usually such a standard of value must depend on the distribution of income. In other words, there is no meaning to total output independent of distribution, i.e., of ethical judgments.

4. DISTRIBUTIONAL ETHICS COMBINED WITH INDIVIDUALISM

We may examine briefly a set of assumptions about individual values which seem to be common to those who feel that the new welfare economics is applicable in a fairly direct way to the solution of specific economic problems. It is assumed that there are (1) an accepted (let us say, unanimously accepted) value judgment that if everybody is better off (more precisely, if everybody is at least as well off and one person better off) in one social state than another *according to his tastes*, then the first social state is preferred to the second; and (2) a universally accepted ordering of different possible welfare distributions in any given situation. The latter value judgment usually takes an egalitarian form.

This ethical schema is quite explicit

in the work of Bergson; the second value judgment is contained in his Propositions of Relative Shares.[17] The same set of ethics underlies the compensation principle of Professors Kaldor and Hicks. More recently, some proposals made by Professors Johnson and Modigliani for meeting the problem of the increased cost of food due to European demand seem to have been based on value judgments 1 and 2 above.[18] To prevent the inequitable shift in real income to farmers, it was proposed that there should be imposed an excise tax on food, accompanied by a per capita subsidy to consumers. Under the assumption that the supply of agricultural goods is completely inelastic, the tax would be absorbed by the farmers while the subsidy would have no substitution effects at the margin, so that the marginal rate of substitution for any pair of commodities would be the same for all consumers and hence the first value judgment would be fulfilled. The taxes and subsidies perform a purely distributive function and can be so arranged as to restore the status quo ante as near as may be, though actually the payment of a per capita subsidy implies a certain equalizing effect.

The value judgments are assumed here to hold for any individual. Note that even to state these judgments we must distinguish sharply between values and tastes (see Part II, sec. 2). All individuals are assumed to have the same values at any given instant of time, but the values held by any one individual will vary with variations in the tastes of all. Our previous arguments as to the nonexistence of social welfare functions were based on the diversity of values; do they carry over to this particular kind of unanimity?

The actual distribution of welfare dictated by the second value judgment cannot be stated simply in money terms. As Professor Samuelson points out, such a value judgment is not consistent with any well-defined social ordering of alternative social states.[19] The distribution of real income, for a given environment, must vary with individual tastes. Thus, for a given set of individual tastes (as represented by the ordering relations of all individuals, each for his own consumption) and a given environment, there is a given distribution of purchasing power (somehow defined); then exchange under perfectly competitive conditions proceeds until an optimum distribution is reached. The given distribution of real income and the individual tastes uniquely determine the final outcome, which is a social state. Therefore, the given ethical system is a rule which selects a social state as the choice from a given collection of alternative distributions of goods as a function of the tastes of all individuals. If, for a given set of tastes, the range of social alternatives varies, we expect that the choices will be consistent in the sense that the choice function is derivable from a social weak ordering of all social states. Thus, the ethical scheme discussed in this section, which we may term the "Bergson social welfare function," has the form of a rule assigning a social ordering to each possible set of individual orderings representing tastes. Mathematically, the

[17] Bergson, *op. cit.*

[18] D. G. Johnson, "The High Cost of Food—a Suggested Solution," *Journal of Political Economy*, LVI (1948), 54–57; Modigliani's proposals are contained in a press release of the Institute of World Affairs, New York, October, 1948.

[19] Samuelson, *op. cit.*, p. 225.

Bergson social welfare function has, then, the same form as the social welfare function we have already discussed; though, of course, the interpretation is somewhat different, in that the individual orderings represent tastes rather than values and that the whole function is the end product of certain values assumed to be unanimously held rather than a method of reconciling divergent value systems. If the range of tastes is not restricted by a priori considerations (except that they must be truly tastes, i.e., refer only to an individual's own consumption, however that may be defined), then, indeed, the Bergson social welfare function is mathematically isomorphic to the social welfare function under individualistic assumptions. Hence the Possibility Theorem is applicable here; we cannot construct a Bergson social welfare function, i.e., cannot satisfy value judgments 1 and 2, which will satisfy Conditions 2–5 and which will yield a true social ordering for every set of individual tastes. Essentially, the two value judgments amount to erecting individualistic behavior into a value judgment. It is not surprising, then, that such ethics can be no more successful than the actual practice of individualism in permitting the formation of social welfare judgments.

It must of course be recognized that the meaning of Conditions 2–5 has changed. The previous arguments for their validity assumed that the individual orderings represented values rather than tastes. It seems obvious that Conditions 2, 4, and 5 have the same intrinsic desirability under either interpretation. Condition 3 is perhaps more doubtful. Suppose there are just two commodities, bread and wine. A distribution, deemed equitable by all, is arranged, with the wine-lovers getting more wine and less bread than the abstainers get. Suppose now that all the wine is destroyed. Are the wine-lovers entitled, because of that fact, to more than an equal share of bread? The answer is, of course, a value judgment. My own feeling is that tastes for unattainable alternatives should have nothing to do with the decision among the attainable ones; desires in conflict with reality are not entitled to consideration, so that Condition 3, reinterpreted in terms of tastes rather than of values, is a valid value judgment, to me at least.

VERTICAL INTEGRATION AND ANTITRUST POLICY

JOSEPH J. SPENGLER
Duke University

This man went down to his house justified.—LUKE 18:14

RECENT decisions suggest that the United States Supreme Court is beginning to look upon integration as illegal per se[1] under the antitrust laws. It may be presumed, in so far as this inference is valid, that the Court believes that integration necessarily reduces competition "unreasonably."[2] No sharp distinction is made by the Court between vertical and horizontal integration.

It is the purpose of this note to show that the Court is mistaken in its implied assumption respecting the influence of integration upon competition. Horizontal integration may, and frequently does, make for higher prices and a less satisfactory allocation of resources than does pure or workable competition. Vertical integration, on the contrary, does not, as such, serve to reduce competition and may, if the economy is already ridden by deviations from competition, operate to intensify competition. My argument will be confined largely to this last proposition.

I

Let us assume a product that, upon passing through three successive stages of production, A, B, C, is ready for sale to consumers. Suppose, further, that there is no vertical integration of stages; that each stage of production is completed by an independent firm; that the variable agents utilized in each stage are forthcoming under conditions of perfectly elastic supply; that each firm sells its product under conditions of pure competition; and that the nonvariable and/or entrepreneurial assets invested in each firm earn a minimum necessary "profit" per unit of output.

Let P_a, P_b, and P_c represent the selling prices, respectively, of the products of firms in stages A, B, and C. Let V_a, V_b, and V_c represent the variable costs per unit, respectively, of the products of firms in stages A, B, and C, with marginal cost (i.e., M_a, M_b, M_c) equal to average variable cost in each stage and at all relevant levels of output. Accordingly, since the product distributed to consumers at the termination of stage C by firms in this stage embodies the variable outlays per unit made in each stage, together with the minimum necessary "profit" per unit, this product will be sold, under the conditions stipulated, at price P_c. This price is made up of variable cost per unit $V_a + V_b + V_c$, together with the cumulated minimum necessary "profit."

Under conditions such as those given, entrepreneurs will be without incentive to integrate the activities of their firms with those in preceding and succeeding stages. For vertical integration as such would neither reduce cost per unit in any stage nor make possible the realization of greater "profit." Accordingly, it is a matter of indifference to consumers and producers alike whether integration is effected or not.

II

Now let the conditions stated in Section I be modified. Let the stages remain vertically unintegrated, with variable costs subject to the stipulations made above. But let it be assumed that enough horizontal integration

[1] A restraint of trade is describable as illegal per se under our antitrust laws if, in the opinion of the highest court, this restraint is unlawful in and of itself. The per se doctrine has been used most frequently in the past in cases involving price-fixing. Recourse to this doctrine is made attractive by the fact that its use enables the Court to avoid the so-called ambiguities of the "rule of reason."

[2] Documentation is supplied by M. A. Adelman in his "Integration and the Antitrust Laws," *Harvard Law Review*, LXIII (1949), 27–77, esp. pp. 52–54, 56, 76. See also his "The A & P Case: A Study in Applied Economic Theory," *Quarterly Journal of Economics*, LXIII (1949), 244–46.

has been achieved *within* each of the three stages to enable the firms composing each stage to sell at supracompetitive prices and earn supracompetitive profit per unit. Let the profit actually realized per unit by representative firms in each stage be R_a, R_b, and R_c; let variable costs incurred in each stage necessary profit per unit.

What has been said is illustrated in Figure 1. Demand curves D_a, D_b, and D_c confront representative firms in stages *A*, *B*, and *C*, in each of which, it is supposed, *horizontal* integration has proceeded far enough to cause the firm's marginal revenue

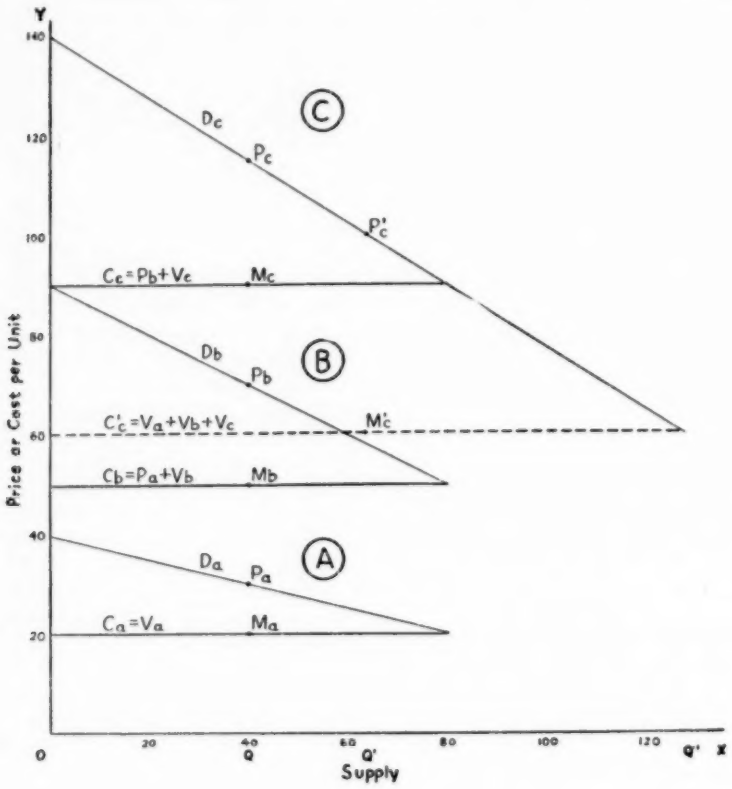

FIG. 1

be represented by V_a, V_b, and V_c; and let total variable costs to firms in each stage be represented by C_a ($= V_a$), C_b ($= V_b + P_a$), and C_c ($= V_c + P_b$). Accordingly, $P_a = C_a + R_a$; $P_b = C_b + R_b$; and $P_c = C_c + R_c$. The consumer of the product moving out of stage *C* now pays for it a price per unit that exceeds the former per unit price by $R_a + R_b + R_c$ minus the cumulated minimum curve to fall faster than its demand curve. Our representative firm in stage *A* (at the bottom of the chart) produces $Q = 40$ units of product at an average (= marginal) cost of $V_a = 20$. These 40 units are sold to a representative firm in stage *B* (see middle of chart) at price $P_a = 30$, which thus includes a profit of 10 per unit; for P_a on demand curve D_a corresponds to the inter-

section of marginal cost curve C_a (= V_a) by the undrawn[3] marginal revenue curve at point M_a. The firm in stage B combines with a unit of product from stage A a variable input of $V_b = 20$. Accordingly, the marginal (= average) cost of producing a unit of B is C_b (= $P_a + V_b$), or 50. The output Q (= 40) of the representative firm in stage B in turn is sold to representative firms in stage C at a price of $P_b = 70$, which thus includes a profit of 20 per unit; for P_b is the point on D_b corresponding to the intersection of marginal cost curve C_b by the undrawn marginal revenue curve at point M_b. The representative firm in stage C (see top of chart) combines with a unit of B costing P_b (= 70) a variable input V_c (= 20), thereby incurring a marginal (= average) cost of C_c (= $P_b + V_c$), or 90 per unit. The stage C firm in turn markets its output Q (= 40) to consumers of C at price P_c (= 115), which includes a profit of 25 per unit; for P_c is the point on D_c corresponding to the intersection of marginal cost curve C_c by the undrawn marginal revenue curve at point M_c.

Let us summarize the transactions described. The final price of a unit of product C, P_c (= 115), is made up of variable cost $V_a + V_b + V_c$ (= 20 + 20 + 20) and profit $R_a + R_b + R_c$ (= 10 + 20 + 25). Since, given the assumed coefficients of production, the output in each stage is always Q (= 40) units per firm, the aggregate variable cost of the 40 units of C is 2,400, the aggregate profit is 2,200, and the aggregate sales value is 4,600. Under the conditions of Section I, P_c would equal $V_a + V_b + V_c$ plus the minimum profit per unit necessary in stages A, B, and C; the volume of output and sales, therefore, would be much greater than under the conditions of Section II. If, for example, each stage C firm were confronted by a demand curve D_c and required to sell the amount which would equate average cost and average revenue, it would produce and sell much more than Q (= 40), but less than Q'' (= 128), the amount salable when minimum required profit is zero and price asked is C'_c (= 60).

The changed circumstances of sale introduced in stages A, B, and C under the conditions of Section II have enabled the firms in each of these stages to impose a surcharge in excess of the profit required under the conditions of Section I. This surcharge always exceeds the Section I minimum necessary profit, when expressed in per unit terms. Whether, however, the aggregate amount of this surcharge is greater relative to entrepreneurial investment than was the aggregate minimum necessary profit supposed in Section I turns on the ease of entry, aggressiveness of selling, etc., along with other Section II conditions.[4] The reduction in output and sales, together with the increase in price and profit per unit, which accompanied the replacement of the conditions of Section I by those of Section II, is attributable to the deviations from competition produced in stages A, B, and C. These deviations, we shall suppose, had their origin in the degree of increase in ***horizontal*** integration implied by the change in conditions. Of course, how much horizontal integration needs to be supposed depends, ***ceteris paribus***, on the amount of product and/or customer differentiation assumed.

III

In Sections I and II, firms in stages A, B,

[3] The marginal revenue curves corresponding to demand curves D_a, D_b, and D_c have not been drawn because their presence would clutter up the chart. The points of intersection of these marginal revenue curves with relevant marginal cost (= average cost) curves are indicated by points M_a, M_b, and M_c in stages A, B, and C, respectively. The profit-maximizing prices, P_a, P_b, and P_c, are found, therefore, at the points on D_a, D_b, and D_c which correspond to M_a, M_b, and M_c.

[4] E.g., see J. Robinson, *Economics of Imperfect Competition* (London: Macmillan & Co., 1933), chap. vii; and E. Chamberlin, *The Theory of Monopolistic Competition* (3d ed.; Cambridge: Harvard University Press, 1938), chap. v. In a sense the model I have employed implies a degree of ease of entry that may appear to be inconsistent with the use to which the model has been put. This model, it must be kept in mind, however, is intended merely to describe how vertical integration may bring about a better use of resources along the lines indicated in Section III below.

and C were vertically unintegrated. Let us retain the degree of horizontal integration implied in Section II and the resulting individual firm demand curves (D_a, D_b, and D_c) obtaining in stages A, B, and C. But let us also suppose that a representative firm in stage A, together with one in stage B, is integrated with one in stage C. We shall use for illustrative purposes the data summarized in Figure 1. Vertical integration, under the conditions assumed, it will be shown, benefits both producer and consumer.

It being assumed that the object of the integrated firm is to maximize return above variable outlay, it follows that this firm will lower the price of its product at the completion of stage C below $P_c = 115$. Of course, the integrated firm might seek, as did the unintegrated firms, in Section II, to maximize profit within each stage and to transfer product from stage A to stage B at price P_a and from stage B to stage C at price P_b. If such an interdepartmental transfer-price and costing policy were followed, the profit realizable in stage C would remain as before, $Q(P_c - M_c)$, or 1,000; and the aggregate profit in all three stages would remain as before, $Q[P_c - (V_a + V_b + V_c)]$, or 2,200. This aggregate is less, however, than the aggregate which is realizable, namely, $Q'(P'_c - M'_c)$, or 2,560. The constant *variable* costs per unit of output in stages A, B, and C of the integrated firm are, respectively, V_a, V_b, and V_c. The aggregate *variable* cost per unit at the close of stage C is $C'_c (= V_a + V_b + V_c)$, or $M'_c (= 60)$. $P'_c (= 100)$ is the point on D_c corresponding to the intersection of the marginal (= average) cost curve C'_c by the undrawn marginal revenue curve at M'_c. At price P'_c consumers purchase $Q' (= 64)$ units of C, expending thereupon $P'Q' (= 100 \times 64)$, of which 2,560 represents "profit" (i.e., return above variable expense) and 3,840 represents variable expense.

Under the conditions assumed both the consumers and the firm benefit. Aggregate consumers' surplus (in the Marshallian sense) increases by 780.[5] Aggregate "profit" (i.e., return above variable expense) increases from 2,200 to 2,560.

Realization of this increase in "profit," given the cost conditions assumed, is possible only so long as the demand for C (i.e., D_c) remains sufficiently elastic. Thus, in the case in hand, the decline in price from P_c to P'_c (i.e., from 115 to 100) was accompanied by a sufficiently greater relative increase in output from Q to Q' (i.e., from 40 to 64). Under all cases conceivable, however, within the framework here employed, the elasticity of demand for a later-stage (e.g., C) product is sufficiently elastic to make price reduction consequent upon vertical integration under circumstances such as were assumed in Figure 1. This conclusion is easily illustrated. If marginal cost is zero, price will not be reduced, under conditions of imperfect competition, below the level at which demand is unitarily elastic. Accordingly, if cost and therefore marginal revenue are positive, the profit-maximizing price will be found at a point where demand is more than unitarily elastic. In general, every increment in cost, whatsoever its origin, is accompanied by a relatively greater increment in the elasticity of demand at the associated profit-maximizing price. Such increment in cost may have its origin in the introduction of horizontal integration (or equivalent competition-suppressing measures) in earlier stages. If this be the case, vertical integration of theretofore unintegrated stages of production can make for increases in both aggregate profit and "consumers' surplus." Moreover, *ceteris paribus*, the greater the "monopolistic" surcharges being levied in earlier stages and the higher the variable cost in later stages, the more elastic will be the demand confronting a representative newly and vertically integrated later-stage firm, and the greater will be the price reductions this firm finds advisable.[6]

[5] I.e., by $Q(P_c - P'_c) + [(Q' - Q)(P_c - P'_c)\frac{1}{2}]$.

[6] Let p represent the profit-maximizing price; r, the marginal revenue corresponding to p; c, the marginal cost when the volume of sales is such as to make $c = r$; e, elasticity of demand at p; e', elasticity of demand at price $p + \Delta p$. Then $e = p/p-r$; and when, the firm being in equilibrium, $r = c$, $e = p/p-c$, and $p = c(e/e-1)$. An increment (Δc) in cost

It has been shown that when a noncompetitive seller is able, by discrimination or monopsonistic practices, to evade payment of some of the rents which, under competition, pass to scarce factors, this seller will produce and sell more than when he is required to pay the rents in question.[7] But, in the absence of a not very likely combination of rent evasion and economies of scale, he will produce and sell less than a producer operating under conditions of pure competition. We have ruled out economies of scale because they are irrelevant to the main problem here under consideration. Even so, the case presented earlier resembles cases in which an imperfectly competitive seller, having evaded rents, asks lower prices. For our vertically integrated producer has been enabled, through vertical integration, to evade the rentlike "monopolistic" surcharges being imposed by sellers situated in earlier stages of production. Vertical integration, in short, has permitted our producer to evade imposts generated by horizontal integration and similar arrangements and thus reduce his selling prices below the level that would obtain in the absence of vertical integration. Vertical integration serves, therefore, to make price structures and factor allocation more ideal than they otherwise would be in an imperfectly competitive world.

Vertical integration can be made the consumer-saving answer to diverse "nuisance" taxes and "monopoly"-price-fixing arrangements that have been established by federal and state governments (e.g., "fair trade" acts, federal farm price supports, etc.). For vertical integration permits evasion of transfers which, because they involve change of ownership, subject the transaction to regulation. Thus a great vertically integrated concern, whether private or a consumers' co-operative, should be able to operate much more economically than can a chain of nonintegrated concerns, since the integrated concern can evade the many monopolistic surcharges and governmental taxes and cost-increasing restrictions incident at points where ownership is transferred. On this matter, the experience of economies that have employed turnover taxes is of some interest.

IV

At the outset of this paper, I indicated that the United States Supreme Court is evidencing some disposition to look upon integration as unreasonably restrictive of competition, be that integration horizontal or vertical. Consideration of the nature of competition discloses it to be horizontal rather than vertical in character, this in fact being the kernel of truth in theories of noncompeting groups.[8] It follows, accordingly, that horizontal integration may, if it is carried far enough, serve to reduce competition. It does not follow, however, that horizontal integration is describable as illegal per se under our antitrust laws when they are interpreted in the light of economic analysis. Here, above all, there is need for recourse to the rule of reason. For, given economies of scale and firm elasticities of actual and potential supply of particular commodities, horizontal integration reduces workable competition only after it has been carried beyond a certain point.

Vertical integration, as such, does not necessarily suppress competition. While reduction of competition is sometimes associated with the extension of vertical integration, analysis usually discloses such reduction, if in fact it exists, to be largely the fruit

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c (originating in a monopolistic surcharge or otherwise) is always accompanied by a relatively greater increment Δc in c. For example, given a straight-line demand curve, an increment of change (Δp) in p is accompanied by an increment of change (Δr) in r double that in p (i.e., $\Delta r = 2\,\Delta p$). Accordingly, suppose that, with $r = c = 0$, we increase c (and therefore r) by Δc. Then ϵ, which had a value of unity when $r\,(=c)$ had a zero value, increases to $\epsilon' = p + \Delta p/p - 2\Delta p$, the rise in ϵ approximating $3\Delta p/p$. When $r = c > 0$, the relative rise in e attendant upon a given increase Δc in cost (= revenue) is greater still, varying directly with the magnitude of c.

[7] E.g., see Robinson, *op. cit.*, chaps. xi, xxiii.

[8] Not all "horizontal" economic relationships are competitive, nor is it always easy to determine in what "layer" to place members of particular groups.

of *horizontal* integration and/or related arrangements. Qualifying adjectives have been introduced to allow for the supposition that, when vertical integration exists, transfer prices from some divisions to others of an integrated concern may be too high in the light of costs and/or alternative supply prices. Yet, even if this be the case, it will make for higher prices only if the end-product is sold in an imperfectly competitive world or if, the firm's demand being imperfectly competitive, it overestimates true costs and underestimates elasticity of demand.

Of great importance is the conclusion, developed earlier, that in an imperfectly competitive world vertical integration enables the higher-stage producer to evade "monopolistic" surcharges imposed by suppliers in lower stages, thus putting him in a position where he finds it advantageous to ask lower prices than would be asked in the absence of vertical integration and in the presence of existing horizontal integration. It follows that vertical integration, if unaccompanied by a competition-suppressing amount of horizontal integration and if conducive to cost and price reduction, should be looked upon with favor by a court interested in lower prices and a better allocation of resources. It should not be viewed as illegal *per se*, or as in unreasonable restraint of trade, unless the presence of significant horizontal elements makes it so. And if this be the case, it is the horizontal elements that need be singled out for remedial treatment.

THE UNITED NATIONS AND FULL EMPLOYMENT

KENNETH K. KURIHARA
Rutgers University

SINCE nations are "once again" concerned about the problem of unemployment, the United Nations has published a timely report, prepared by J. M. Clark, A. Smithies, N. Kaldor, E. R. Wilson, and P. Uri, in order to "provide a framework within which the countries of the world can obtain the advantages of both full employment and an expanding volume of world trade."[1] The report, while it is presented primarily "for the consideration of Governments," is of great interest to economists because it reflects the present state of international thinking on the problem of full employment. The purpose of this note is to comment on some of the report's specific points of a controversial nature.

The over-all picture closely follows the familiar Keynesian pattern, namely, (*a*) the rejection of the assumption of automatic full-employment equilibrium, (*b*) the recognition of mass unemployment mainly as a matter of insufficient and unstable effective demand, (*c*) the strategic importance of "stabilizing the rate of investment" in mitigating fluctuations in the levels of income and employment, and (*d*) the compatibility of domestic employment and international equilibrium. As might be expected, however, the details are by no means such as to give this Keynesian effect. This fact reflects in part the heterogeneity of the authors' economic thinking and in part the difficulty of a common approach to full-employment policies. Without losing sight of the general effect, let us examine the details.

The authors argue that the full-employment measures they recommend "do not involve any basic change in the economic institutions of private enterprise countries."[2] But the report fails to show why and how the goal of "full employment in a free society" can be reached through monetary-fiscal and other "indirect methods." Such a failure is regrettable for two reasons. First, it will have the effect of strengthening the opposition to full-employment policies precisely when comparative prosperity tends to remove the incentive to experiment with even the mildest Keynesian policies. Second, it will leave many proponents of full employment confused as to freedom as an end and as a means.[3] Perhaps this failure is due to the fact that some of the authors of the report are so accustomed to central and direct

[1] United Nations, *National and International Measures for Full Employment* (Lake Success, N.Y., December, 1949).

[2] *Ibid.*, p. 7.

[3] Keynes rejected "authoritarian" measures to maintain full employment as impairing "efficiency and freedom" but did not show just how his policy would preserve efficiency and freedom (see *General Theory* [New York: Harcourt, Brace & Co., 1936], p. 381). The 1950 *Report of the Subcommittee on Monetary, Credit, and Fiscal Policies* of the Joint Committee on the Economic Report is more helpful in this respect, as it makes clear at the outset "the difference between the effect of general over-all monetary, credit, and fiscal policies which indirectly influence the economy toward stabilization and the effects of an elaborate system of direct controls" (pp. 9–11). Failure to make this distinction might easily mislead one to exaggerate "the dilemma which exists in reconciling the control of the economy with the maintenance of individual liberty" or to reject government responsibility for full employment on the ground that "a government has no means to maintain full employment except in a totalitarian society." The result is that even the mildest liberal Keynesian full-employment policy is often opposed for fear of "statism" or "collectivism." A. Smithies, one of the authors of the report, elsewhere has this to say: "Such a policy [fiscal] is held to lead to socialism, communism, or fascism. Even if this were true, the possible alternatives, including mass unemployment, might prove to be shorter and faster routes to damnation" ("Federal Budgeting and Fiscal Policy," in *A Survey of Contemporary Economics*, ed. H. S. Ellis [Philadelphia: Blakiston, 1948], p. 177).

controls as to underestimate the resistance to such controls that exists in "private enterprise countries." Nevertheless, this omission is serious because private enterprise countries are the hardest to convince of the wisdom of "indirect methods."[4]

The report shows how "unemployment in industrialized countries" is caused mainly by "the insufficiency and instability of effective demand."[5] Yet it has apparently failed to convince one of its authors, J. M. Clark, and perhaps others of the adequacy of treating the problem of unemployment as a matter of effective demand. So we find Clark saying, in his supplementary statement, that unemployment in "some industries" and "some countries" might be affected more or less by an insufficient profit margin resulting from "extra-high wage-rates."[6] It is interesting to note that Keynes himself, before his *General Theory*, was also concerned about unemployment being caused by "the loss of profit" incident to the high cost of output.[7] The difference between Keynes and Clark on this point is that Keynes definitely preferred an "expansionist" policy of increasing "the demand for output" to a "contractionist" policy of decreasing "the cost of output" for the same purpose of "restoring to employers a proper margin of profit."[8] The report would have been more convincing had its authors shown why the classical "cost approach" to the problem of unemployment was lass plausible and less feasible than the Keynesian demand (income-expenditure) approach.[9]

Another point that is likely to cause controversy is the treatment of the relation between inflation and full employment. It is doubtful that the report succeeds in dispelling "widespread apprehensions lest full employment policies could be pursued only at the cost of continued inflation."[10] The report admits the possibility that inflation "will arise if the stimulation of effective demand to maintain full employment is carried to excess,"[11] but it expresses confidence in the ability of governments, labor

[4] The wisdom of "indirect methods" does not turn on the comparison of full employment and freedom as abstract ideals. Rather, it must be judged by reference to the concrete institutional-psychological complex of society. Apropos of this is T. Balogh's observation: "In a country such as, for example, the United States, which is largely independent of foreign fluctuations and which, through the historical accident of being the arsenal of the major part of the world in the two world wars without suffering any economic loss in her own territory, has become by far the richest country of the world, with an enormous potential capacity for investment and accordingly of rate of progress, *controls can be restricted to a minimum. It is possible in that country to maintain full employment by fiscal measures alone*" (see his *The Dollar Crisis* [Oxford: Blackwell, 1949], p. 106). (My italics.)

[5] *Op. cit.*, pp. 13 and 19–33.

[6] *Ibid.*, p. 102. Cf. Clark's remark with the following statement by A. C. Pigou: "Thus, while nobody would ever have formally argued that, because reduction in money wages in a particular industry usually increases employment there, *therefore* a reduction all round would usually increase employment all round, nevertheless the possible indirect effects of wage cuts upon prices and incomes had certainly not received adequate attention. Keynes brought this central and very important matter to the forefront of discussion" (in *John Maynard Keynes, 1883–1946* [Cambridge: Council of King's College, 1949], p. 22).

[7] J. M. Keynes, *Essays in Persuasion* (New York: Harcourt, Brace & Co., 1932), p. 275.

[8] *Ibid.*

[9] Without repeating the familiar argument of the *General Theory* regarding the dichotomy between microeconomics and macroeconomics, I interpret Keynes's demand approach to employment thus: While fiscal-monetary policy can increase "the demand for output" without any change in "the cost of output," the traditional "contractionist cure"—the main weapon of laissez faire—cannot decrease the cost of output except by diminishing the demand for output as well. For the latter cure involves a general reduction of money wages and all other incomes in its wake. Moreover, measures to decrease the cost of output may well diminish "efficiency and freedom" along with the cost of output. For in this case free trade-unionism might be emasculated, monopolistic malallocation of resources encouraged, "sweating systems" introduced, and so on—all in the name of restoring to employers such a margin of profit as to increase total employment—but at the expense of "efficiency and freedom."

[10] *Op. cit.*, p. 43.

[11] *Ibid.*

unions, and managements jointly "to prevent prices from rising without reducing the volume of effective demand below full-employment levels."[12] A bias against deflation, while quite understandable in the light of bitter past experience, is carried in the report to the unnecessary extent of denying the manipulation of demand as applicable to inflation as well as to full employment. This is to deny that the explanation of inflation is a part of the theory of effective demand. Thus we are told that inflation "is not necessarily indicative of an excess of effective demand" and therefore requires more than "automatic measures."[13] It is true that general prices may rise as a result of all sorts of "bottlenecks" even before full employment, but such "semi-inflation" is irrelevant here. What is at issue is "true inflation," which arises from increasing effective demand beyond the level necessary to maintain full employment.[14]

Even though those who oppose full-employment policies on the ground of inflationary danger may be motivated by the fear of direct anti-inflation measures that may "undermine or destroy the individual competitive system," the case for full employment is not strengthened by attributing inflation to some other causes than a rise in effective demand or by understating the danger in deflating effective demand below the full-employment level. The report seems to underestimate the inelasticity of the unemployment-accustomed mind to which Keynes alludes in his *How To Pay for the War*.[15] For experience shows that economists, no less than policy-makers, accustomed to thinking in terms of depression and mass unemployment, have great difficulty in coping with the problem of inflation in a full-employment economy. Even if there were "the elasticity of mind," an effective anti-inflation policy might be prevented by the fear of deflation. There is nothing in the report that assures one of the possibility of achieving and maintaining full employment without the alternatives of inflation and deflation. Perhaps this is asking too much, for "what is needed to secure stability and greater social justice is not the mitigation or counterbalancing of business cycles, but their elimination," as one economist puts it.[16] The report could have paid more attention to the problem of inflation in a full-employment economy if for no other reason than that full-employment policies are opposed most strongly by the "rentier class" who stand to lose most by the falling value of money during a period of rising general prices, in "private enterprise countries" at least.

Still another point to consider is this statement in the report: "Economies that make widespread use of central planning and control are obviously in a better position to undertake the direct stabilization of investment than private enterprise economies relying on a free price mechanism. There can be little doubt, however, that with properly thought out methods and sufficient preparation, private enterprise economies could also accomplish far more in this direction than was thought feasible in the past."[17] Yet there is no analysis of why and how "a free price mechanism" fails to stabilize investment; the explanation of unstable investment runs in terms of the familiar Keynesian discrepancy between "the decisions to save and the decisions to invest."[18] This latter explanation would be much more convincing if the report explicitly explained the reasons for the unreliability of "a free price mechanism." Failure to do this apparently led J. M. Clark to add that "countries that favour the competitive system believe" that "competitive pressure" may be relied on for "a more vigorous flow of investment."[19] The inability of the unregulated price system to

[12] *Ibid.*, p. 45.

[13] *Ibid.*, p. 46.

[14] On this point see Keynes, *General Theory*, pp. 291, 303–4.

[15] New York: Harcourt, Brace & Co., 1940, p. 17.

[16] Balogh, *op. cit.*, p. 102.

[17] *Op. cit.*, p. 35.

[18] *Ibid.*, pp. 20–21.

[19] *Op. cit.*, p. 102.

bring about sufficient or stable investment is all too obvious to those who have experienced it in other countries but not so obvious to those in the United States who have been brought up on the supreme virtue of "the individual competitive system."[20]

The authors would have made a stronger case for a regulated pricing mechanism or for monetary-fiscal policy for "stabilizing the rate of investment" had they demonstrated the theoretical possibility of insufficient and unstable private investment even in the most perfect of perfect competition. All that is needed is to make plausible assumptions regarding the parameters of the Keynesian functions (i.e., the interest elasticity of the liquidity, savings, and investment functions), at any rate for advanced capitalistic economies. Otherwise one gains the false impression that the savings-investment equilibrium is always given at the full-employment level through the pricing mechanism, that is, through changes in the rate of interest. The report does mention some structural and exogenous factors making for insufficient and unstable investment, such as capital accumulation, inventions and innovations, wars, and social and political changes.[21] But obviously this does not entirely account for the interest or income inelasticity of the investment function in the short run.

The report, while recognizing the compatibility of domestic full-employment policies and international equilibrium, is nevertheless pessimistic regarding the prospect of early restoration and maintenance of multilateral trade for three reasons. First, cyclical fluctuations in the effective demand of the unplanned sector of the world economy compel many trading countries to retain or adopt protective measures of discrimination. Second, the "chronic imbalance in international trade" that has persisted "remains by far the most disturbing feature of the current situation," calling for some fundamental structural adjustments and drastic monetary reform. Lastly, there is not effective synchronization of domestic full-employment policies, balance-of-payments policies, and long-range international developmental policies within the framework of the existing United Nations agencies. All this is familiar ground, but what deserves attention is the specific measures recommended for "full employment and an expanding volume of world trade."

To prevent adverse balances of payments from frustrating domestic full-employment policies, the report recommends the adoption of a system of "compensatory deposits" by the International Monetary Fund.[22] The principle involved is this: The "depositor country" (a surplus country like the United States) is required to deposit in its own currency with the I.M.F. the equivalent of the value of imports which falls "as a result of a fall in effective demand within the country," provided that "this fall is not fully offset by a decline in the value of its current exports." The purpose of such a deposit is to enable the "purchasing country" (a deficit country) to make use of it rather than to restrict its imports. The "purchasing country" is, under the proposed scheme, entitled to buy the currency of the "depositor country" through the I.M.F. in an amount equal to a net debit in its current transactions with the depositor country. For self-equilibrium the depositor country is to use the credit so accumulated in purchasing from the purchasing country, thus wiping out its credit. This scheme is certainly superior to the present arrangement, since it requires a

[20] "Those who reject *laissez-faire* and the so-called 'planning by the price-mechanism' base their rejection on the bitter experiences of Britain in the inter-war period, which is reinforced by all that has happened since the end of the war. This experience shows that, at any rate in Western Europe and Britain, an uncontrolled market economy cannot in the essential matter of capital investment and saving give effect to the wishes of individuals, far less of the community, and that its functioning involves injustice, inefficiency, wastage and unemployment" (see Balogh, *op. cit.*, p. 97).

[21] *Op. cit.*, pp. 23–24.

[22] *Op. cit.*, pp. 63–64, 97.

surplus country to compensate for any fall in its imports resulting from its failure to maintain a high level of effective home demand and since it relieves a deficit country of the necessity of taking domestic steps to insulate itself from the repercussions of a fall in effective world demand.

The only apparent weakness of the scheme is that the obligation of a depositor country to compensate for a fall in the exports of a purchasing country can be "waived" if the depositor country can "show, to the satisfaction of the Fund, that the fall in its external currency disbursements on current accounts was due in part or in whole to factors other than a reduction in its import demand caused by a fall in effective demand within the country or other than a restriction of imports that was not made necessary by an adverse balance of payments."[23] This "escape clause" might well turn out to defeat the purpose, for there is a danger that the depositor country will get around the obligation by "proving" that its reduced import demand is due, say, to inflationary export prices elsewhere rather than to decreased domestic incomes. The report fails to indicate unequivocal "factors other than" those caused by "a fall in effective demand within the country." The result might be that the surplus countries would excuse "an undesigned export surplus generated by a fall in their employment" or their failure to increase imports by "passing the buck" to the deficit countries.

As for the modification of the lending policy of the World Bank, the report recommends a shift of emphasis from lending "in special circumstances" to lending "for general developmental purposes." This requires the setting-up of "a new department of the Bank" for raising and lending independently of the Bank's capital and the simultaneous setting-up of "separate capital budgets" by borrowing governments for the purpose of allocating borrowed funds entirely to developmental programs.[24] The report recognizes that the extent of private foreign investment is limited by the impossibility of countercyclical timing of private lending activity, by the general political instability of underdeveloped countries, and by "strong feelings on the conditions under which they [borrowing countries] will admit foreign capital."[25] For these reasons the report considers the World Bank as "the only practicable solution of this problem." What is striking here is the sharp contrast that obtains between the positive attitude of the report and the present negative attitude of the Bank toward the employment-stabilizing aspect of its lending policy.

Let us conclude with the following features of the report that are of especial interest to the American economy:

1. Maintenance of domestic full employment is to be effected by stabilizing effective demand and particularly by "the adaptation of general fiscal and monetary policies" as far as private enterprise economies are concerned.

2. In stabilizing effective demand, "highly industrialized countries" should increasingly look upon "influencing the general level of consumer demand" as a better alternative than controlling investment demand directly. Two reasons are offered for this. First, "the counter-cyclical variation in consumers' demand" would "in itself exert a stabilizing influence on the level of investment" (presumably via the acceleration principle). Second, "a sustained policy of raising consumers' demand in the face of declining investment demand would lead to a gradual adaptation of the industrial structure to a higher level of consumption and thus reduce the scope for instability emanating from the side of investment."

3. "Built-in" stabilizers, such as are involved in "pay-as-you-earn" taxes, "only have the effect of dampening the range of economic fluctuations" and therefore must be coupled with "positive counter-measures" through "counter-cyclical variations

[23] *Ibid.*, p. 97.

[24] *Ibid.*, pp. 92–94.

[25] *Ibid.*, p. 55.

in the rates of taxation" and/or in "the rates of certain types of expenditures."

4. "A flexible fiscal policy" is to be substituted for "the principle of an annual balanced budget." A budgetary surplus during a period of high effective demand and a budgetary deficit during a period of low activity are held compatible with the principle of budget balancing. The report stresses the familiar point that "the burdensomeness" of public indebtedness depends on "the size and growth of the national income." J. M. Clark adds the mental reservation shared by the other authors: "As to fiscal policy, I agree entirely with its dominant importance as a means of stabilizing cyclical fluctuations, and would also be prepared to lean heavily on it for long-run purposes of maintaining a high level or trend of income and employment, though lacking in complete confidence in its capacity to maintain any desired level of national income, under any and all conditions."

5. The stabilization of effective demand leaves some scope for "price-flexibility" as well as for purely monetary controls, provided that it is co-ordinated with the appropriate measures of fiscal policy. The report also refers to the generally shared notion that monetary policy is more effective in arresting credit expansion than in stimulating general activity.

6. Successful maintenance of full employment side by side with international equilibrium requires the solution of chronic imbalance in the balance of payments, the stabilization of the flow of international investment, and monetary measures to absorb the temporary shock caused by the fluctuations in effective world demand. The report emphasizes "a unique position in the world economy" occupied by the United States on two counts, namely, its share in world trade and its income elasticity of demand for imports. The report leaves the unmistakable and perhaps unforgettable impression that the universal drive for full employment, among Western democracies at least, stands or falls with America's ability to maintain continuous high effective demand.

BOOK REVIEWS

The Problem of Employment Stabilization. By BERTIL OHLIN. New York: Columbia University Press, 1949.

For economists interested in employment theory the writings of the Swedish school have a special attraction. The Swedish economists, including Professor Ohlin, anticipated much of the theory that seemed so new to American and English economists in the 1930's, and they have lived longer than we with a coherent income theory. Naturally, one wants to see what they have been able to do with it, and one approaches this little book of Ohlin's with considerable curiosity.

Unfortunately, this curiosity remains unsatisfied. The book consists of seven lectures on various aspects of employment theory delivered by Ohlin in 1947. For the most part, they cast a gentle glow rather than a piercing light on the matters discussed. It is interesting, of course, to learn the author's conclusions on such matters as fiscal policy, buffer stocks, and so on; but our interest in these conclusions derives from our respect for their author. We can only hope that we shall soon be able to read a more detailed account; public lectures of this sort merely whet the appetite.

In the first essay Ohlin considers the advisability of aiming at full employment in the literal sense, with vacancies outnumbering the unemployed. He presents cogent reasons for preferring a somewhat lower level. Since these reasons—bottlenecks, excessive turnover, and yet low labor mobility of the sort that hastens adjustments to shifting demands, increased costs of buying and growth of bureaucracy, rising prices and weakening foreign balances—may become operative during a rise in employment from a relatively low level, it is obviously difficult to choose an optimum level; and, in so far as these are social costs which are not self-destroying, the optimum level may be rather low. Evidently, a certain number of unemployed are needed to serve as a lubricant in the economic machine. Perhaps their social function as expediters should be acknowledged and suitably rewarded.

Ohlin presents an interesting account of the Swedish program against depression, worked out in the 1930's and modified later. While most of the program is not surprising, some details are noteworthy. For one thing, instead of aiming at a countercyclical urban housing program, Sweden attempts to keep housing investment stable because of the difficulties with labor supply. In 1938, legislation was adopted to allow firms to avoid part of the profits tax, provided that the part not taxed was spent on construction when the government declared demand inadequate. The account of Swedish budget planning is also useful.

A short account of the Swedish "theory of unused resources" leads up to a critical exposition of Keynes's analysis. This, to me, was the most useful and instructive part of the book. It will be worth while to deal with some of these criticisms, though in the space available no more than the smallest suggestion of an answer is possible.

Ohlin finds that Keynes's theory is oversimplified and that, by reason of its failure to distinguish ex post and ex ante concepts, it is misleading. The heart of the matter is that saving ex ante need not equal investment ex ante; unintentional saving (dissaving) and investment (disinvestment) will help to bring the ex post concepts to the same value. This is true; and what it means, surely, is that a theory must be able to take account of the effects in subsequent periods of any disappointment of expectations, or the reverse, in the base period; otherwise the theory is useless. A period analysis compels us to consider these matters; and, if we know how to make such an allowance, we can incorporate our findings in the analysis by periods. But we can also incorporate these findings, if the knowledge is available, into a Keynesian framework. We have simply to allow for the effect of disappointment upon marginal efficiency or the propensity to consume. With water, fire, and an egg, you can boil the egg in any shaped pot. As a matter of fact, Keynes shows in the *General Theory* (p. 318 for one of several examples) that such considerations can be handled within his formulation.

Ohlin criticizes the multiplier concept on

several grounds. The multiplier will vary more than has been realized because of the likelihood of unintended saving (or dissaving) in periods of change. In a decline the marginal propensity to consume may be relatively low; hence the multiplier will be low. But why, on this account, discard the multiplier? It allows us to deal with the very developments that interest Ohlin—divergences between plans and realizations (this matter is raised in the *General Theory*, pp. 133–34). Nor can I follow his reasons for condemning the multiplier because it treats only one effect of an initial change in investment. True, the acceleration effect is also important, but it is surely wise to separate these two developments and consider them singly.

Ohlin also criticizes Keynes's acceptance of the wage–marginal productivity equality, justifiably, I believe; but this is not integral to Keynes's income theory. Ohlin does not accept Keynes's view of investment opportunities, and he prefers a different formulation of interest-rate theory. In general, Ohlin has presented an alternative approach; he does not convince me that it is better.

One can only regret that this slight, though interesting and readable, book affords Ohlin so little opportunity for developing matters that are important and about which we can be sure he has thought deeply. It is an appetizer, but not a meal.

LORIE TARSHIS

Stanford University

Competition among the Few. By WILLIAM FELLNER. New York: Alfred A. Knopf, Inc., 1949. Pp. ix+328. $5.00.

This volume presents a scholarly exposition and extension of the various theories of oligopoly, including chiefly the theories of Cournot, Bertrand, Edgeworth, Stackelberg, and Chamberlin. Professor Fellner emphasizes (*a*) the wide variety of actual and anticipated reactions to individual prices and other variables, (*b*) Stackelberg's three-dimensional diagrams or "indifference maps," (*c*) the possibilities of joint profit maximization within an industry, and (*d*) leadership and followership among firms. Near the end of the book two chapters are devoted to the theory of bilateral monopoly, with special applications to labor-management relations. The last chapter is concerned with details of social appraisal and public policy.

Ordinary students of economics will be repelled by the intricate nature of the analysis. On the other hand, theorists familiar with the literature on oligopoly will be very much inclined to accept Fellner's contribution as a standard work of reference in its special field. For this purpose, the book's usefulness would be greatly increased if a complete bibliography had been included.

From the viewpoint of technical analysis the concept of "reaction function" appears as the most interesting feature of Fellner's presentation. In place of the rigid assumptions of Cournot or Edgeworth, Fellner suggests that each oligopolist may regard competitive action as a *variable* dependent upon his own action in a particular fashion. Such anticipations may be described mathematically in each case by a "reaction function."

This brilliant innovation, however, still implies an oversimplification of business psychology. An alert management will recognize more than one type of possible response to its own action. As in a chess game, where more than one defense can be made against a particular attack, so in any typical oligopolistic situation each competitor is confronted with many different "reaction functions." Thus the solution may not be obtainable by the elementary principles of maxima and minima which bedevil current theories of oligopoly.

A. J. NICHOL

University of Pennsylvania

The Theory of Economic Change. By B. S. KEIRSTEAD. Toronto: Macmillan Co. of Canada, Ltd., 1948. Pp. xi+386. $5.00.

The purpose of this book is to analyze the nature and causes of economic change with a view to formulation of policy in the political economy. The main theme is that population growth and innovations (broadly defined) have been key factors in economic growth. As a result of the fall in the rate of population growth and the development of "trustification" in industry, investment opportunities have declined, and very serious economic (and political) difficulties have arisen. Professor Keirstead sees a wide role for government action in fiscal policy, in the regulation of monopolistic enterprises (perhaps including state ownership in some fields), and in the stimulation of research and development of innovations.

The book is in six parts. In a discussion of methodology (Part I) and the nature of general theories of economic change (Part II) the author seeks an eclectic approach involving all the social sciences. As far as possible, all variables are to be endogenous. Models of the general economy (Part III) are developed to examine the interactions of population growth and innovations with other economic phenomena. And in the following section (Part IV) models of the firm are discussed. From the latter, the conclusions are drawn that modern technology leads to bigness, owing to economies of scale, and that firms may delay in introducing innovations, once they acquire an assured monopolistic position. This is followed by an examination, with the use of considerable quantitative data, of the effects on industry in the Maritime Provinces of Canada of the historical development of the Canadian economy (Part V). The relative decline in industry in the Maritimes is attributed to the growth of large-scale industry (with its attendant economies) and consequent centralization near the large centers of population of Ontario and Quebec. The final section, on policy (Part VI), is more a treatment of spheres of action than of specific policy proposals. The part that institutions play in economic matters is emphasized, special attention being given to the development of monopolistic power associated with the rise of big business and pressure groups. Keirstead argues that these developments place limits on government action but that there remains scope for a wide program along the lines already indicated.

Recent literature and research reveal a growing interest in economic growth. Yet, aside from the work of Schumpeter, Colin Clark, and a few others, which deal with some phases only, little attention has been given in recent times to a general theory of economic change. Much of the background work necessary for a satisfactory comprehensive theory is not yet done. Accordingly, the author, in attempting a general view, is imposing a heavy burden upon himself. He brings to the task the results of a great deal of exploration and thought. The outcome is a stimulating book, written in distinctive style. And, though it admittedly does not contain much that is really new in any of its separate parts, a somewhat different view of the whole is given in the collection of much diverse material in one place and in the emphasis on various forces.

At the same time, evidences of the difficulties of taking such a comprehensive approach appear in comparative overdevelopment in some respects and underdevelopment in others. For instance, in the sections on the models, parts of the material on the firm should be well known to those competent to read the rest of the book, and parts of the general models provide an apparatus of which little use is made elsewhere. Conversely, though much attention is given to political and institutional matters, practically no mention is made of the development of social security. Yet, surely, it is one of the outstanding features of institutional change. Similarly, on economic matters more quantitative material would have been illuminating.

With regard to emphasis, many will wonder whether the part attributed to the growth of monopoly in limiting investment warrants the importance given it. Much weight is attached to manufacturing; but it has never absorbed more than one-fifth of the total capital in the American economy. The regulation of utilities eliminates many of the ill effects of monopoly, and elsewhere a good deal of competition still exists.

The present volume has probably carried general theorizing concerning these things about as far as it can be taken fruitfully with available information. What is now needed is more work on the many details of the problem. For instance, we should like to know more about how technological change actually does work out its effects through an economy, or the extent to which imperfect competition does curtail investment. With such information, it will be possible to attack the general problem much more easily and surely.

M. C. URQUHART

Queen's University

La courbe d'offre. By JANE AUBERT. Paris: Presses universitaires de France, 1949. Pp. 266. Fr. 600.

The spirit of sheer joy in invention exuding from its pages insures that Mlle Aubert's work is an appropriate addition to the vigorous "Théorie" series put out under the direction of François Perroux. The author also commends herself to the reader by her lack of pretense and her thorough acquaintance with and understanding of the literature. She has set herself to develop yet further the geometry of market analysis—this and no more. And, while not willing to conclude that the apparatus is entirely

without further relevance to analysis or policy, she only claims that her geometry sins no more in this respect than does much of the received apparatus (p. 30).

The main theme of the book is that the supply curve, which has generally been considered relevant only to the depiction of competitive situations, is equally appropriate and meaningful in at least some alternative market conditions. This is demonstrated beyond dispute. There remains the question to what extent this demonstration should or will serve to modify the point of view and the conclusions of market analysis. It is to be noted that Chamberlin takes no stand on this point in his Introduction to the book.

Mlle Aubert grants that, by and large, there is no such animal as the supply curve of an *industry* in monopolistic competition. In the case of the firm, however, the creature may exist, mainly for the following reasons, which she applies to the monopoly case as well. Where goods are nonreproducible, several fairly obvious cases arise. A trivial one is the case in which the monopolist is not aware of the absence of competitors (the example advanced is the bookseller who is not aware that all other copies of a book in his possession have been destroyed). Also cited is the case of a monopolist who fears that an influx of competitors is contingent on any price rise. In both these cases the seller must take the price to be a parameter to which he must adjust himself as best he can, and this adjustment is, of course, scheduled in a supply curve.

Another case arises in which the entrepreneur is in need of a fixed amount of ready cash but foresees a greatly augmented demand for his commodity in the future. Here the seller may wish to postpone his sales to whatever extent he can, and, provided that the maximum profits he can obtain from present sales are greater than the amount of cash he requires, he will restrict his sales below the maximum current-profit level. In this case his supply curve will clearly be a rectangular hyperbola, which describes the constant area representing the amount he requires in liquid funds.

The case listed by Mlle Aubert as the most interesting of those involving a nonreproducible good appears to me to be spurious. This is where the seller has a reservation demand and, at varying prices, wishes to keep different quantities of the good for himself. Here the author argues that different prices will mean that different residual amounts of the good will be available for sale, and, provided that these amounts do not exceed those giving maximum profits, we will have a supply curve once again. The fallacy here seems to be that the entrepreneur (monopolist) is taken to regard price as a parameter when he consumes his good, even though he considers it to be influenced by his decisions as a seller. If this were not the case, he would, with the perfect information assumed, decide on the unique sales level which set his marginal revenue equal to his marginal *utility*, thus maximizing his total utility. In this case, then, as in the standard case (p. 32), the supply curve degenerates into a supply point.

Where goods are reproducible, the supply curve is constructed on an entirely different basis. Here it is assumed that the seller is uncertain about the demand curve facing him but believes that only one subset (such that every point in the diagram lies on exactly one curve of the subset) of the set of conceivable curves is really possible; for example, he may believe he knows the slope of the demand curve and yet does not know which of the curves having that (constant) slope is the one with which he is faced. In this case the supply curve is defined as the locus of the points giving maximum profits on each of the demand curves which the seller believes possible.

Any attempt at general criticism must necessarily turn into an essay in methodology and "good" theorizing, which, of course, mean different things to different people. On the basis of the summary just presented and the nature of the reader's view of the subject, it should be possible for him to form some opinion of the work. While I have distinct reservations as to its practical relevance or the importance of its theoretical contribution, it is felt that the interested reader will find this book spirited and even stimulating.

One warning should be given those who plan to read Mlle Aubert's book. The extraordinary number of misprints and slips in labeling diagrams may prove extremely annoying and in spots makes the reading very difficult; but anyone who feels the subject matter intriguing should by no means permit himself to be deterred by this alone.

WILLIAM J. BAUMOL

Princeton University

Pioneers of American Freedom: Origin of Liberal and Radical Thought in America. By RUDOLF ROCKER. Translated by ARTHUR E. BRIGGS.

Los Angeles: Rocker Publications Committee, 1949. Pp. xx+215. $3.00.

Only within recent years has serious attention been given by scholars to the development of American "radicalism." This deficiency is explained partly by the fugitive character of the material and partly by the penchant for viewing "radicalism" simply as a "foreign" importation, often involving violence. "Anarchism" in particular has too generally been identified with bomb-throwing. Yet there arose and flourished in America another and peaceful kind of anarchism that seems to be an extreme development of some of the most distinctive American liberal traditions. Its aim was to eliminate all controls, but the end was to be achieved not by violence —indeed, it made a fetish of nonviolence—but by "education, instruction, persuasion of men, so as to prepare them for a condition where authority would no longer rule." And it took the form of purely voluntary associations.

To the pioneers of this "philosophical anarchism," Mr. Rudolf Rocker devotes most of his attention in his illuminating *Pioneers of American Freedom*. He brings to the book a lifelong interest in and study of the anarchist movement and philosophy. Some years ago, he published an anarchistic interpretation of history, *Nationalism and Culture*. *Pioneers of American Freedom* opens with a series of chapters on American liberals, to whom, says Rocker, the "individualistic anarchists" are kin. The author briefly presents the relevant aspects of the work of Paine, Jefferson, Emerson, Thoreau, Garrison, Phillips, and Lincoln. Then he passes to the great "American radicals"—the anarchists Josiah Warren, Stephen Pearl Andres, Lysander Spooner, William B. Greene, Benjamin R. Tucker, and a host of lesser lights.

What joined them to the classic liberal tradition and at the same time distinguished them from other kinds of socialists, as Rocker states, was their emphasis on free competition. They regarded "free competition of individual and social forces as something inherent in human nature, which if suppressed will inevitably lead to the destruction of the social equilibrium." To the Marxian Socialists, who "saw in free competition one of the destructive elements of capitalist society," they answered that the "evil lies in the fact that today we have too little rather than too much competition, since the power of monopoly has made competition impossible." The state socialism of the Marxists was the beginning of the "tyranny of the majority" and would end in the destruction of freedom in all realms.

Since Rocker was concerned with the general problem of "human freedom," it was natural that he should devote little space to the distinctive economic panacea of the anarchists, namely, "free money" or "mutual banking," which was essentially the notion of "managed currency." The management, however, was to be not in the hands of government but in each of the free associations whose members agreed to take the currency among themselves. This basic area of the work of the "philosophical anarchists" should prove fertile to those economists who seek American roots for monetary ideas which have heretofore been traced to a "heretical" British tradition.

Rocker's work is a welcome supplement to Miss Eunice M. Schuster's *Native American Radicalism*. His extensive bibliographies of the members of the school should also be useful for further investigations into the development of American social thought in general and economic thought in particular.

JOSEPH DORFMAN
Columbia University

Stalin: A Political Biography. By ISAAC DEUTSCHER. New York: Oxford University Press, 1949. Pp. 600. $5.00.

The central figures of our major political dramas are usually surrounded by an aura of mystery. They serve as myths and symbols and scapegoats and (since Freud) as father-images. No one doubts that to delineate their roles, to describe the relationships between the chief actors and the supporting casts, and to analyze the circumstances of their rise to dominance and the nature of their power are a major task for all social scientists. For the economist, studies of political leadership are of growing importance because it is the political leader, together with the oligopolist group he represents, who is more and more coming to take the place of the impersonal market mechanism.

Isaac Deutscher, former member of the Polish Communist Opposition and now on the staff of the *Economist*, traces the sources and history of Stalin's rise from a minor Communist professional in backward Georgia to the even more obscure role of the most powerful man on earth. The book is eminently successful in retelling the story of interparty maneuvers and of the party's rise to power. He has no new insights or information to offer, but he relates the saga in

a very readable style, with a minimum of partisan judgment and an authoritative marshaling of all the available materials.

Stalin's ascendancy, in the author's view, is to be accounted for primarily by the ossification of the party, an occurrence which allowed the Great Administrator to take the dominant role. The ossification was necessary because "to save the revolution's conquests it [the party] had to suppress the spontaneous rhythm of the country's political life. But in doing so, the party was mutilating its own body and mind" (p. 226). A second basic explanation offered by Deutscher for Stalin's rise is the general cultural backwardness of Russian revolutionary society, both the administrators and the masses—it was a feeling of inferiority which inclined the newcomers to imitate the old rulers' customs and habits. Stalin best represented these backward elements.

One would think that, if these were the forces which created Stalin, his would be a counter-revolutionary position. On the contrary, Deutscher classifies Stalin along with Cromwell and Napoleon as "guardians and trustees of the revolution." Stalin's administered innovations —collectivization, industrialization, and planning—are equal in social impact to Lenin's political revolution. "He 'built socialism'; and even his opponents, while denouncing his autocracy, admitted that most of his economic reforms were indeed essential for socialism. The revenge of the past thus bore not on his social programme but on his technique of government. It was mainly in that that the 'low and miserable' tradition of Tsardom came to predominate" (p. 361).

Deutscher's reliance on these two traditions to which Stalin was heir—western European socialism and autocratic Russianism—to explain both the good and the bad features of Stalin's Russia is much too simple. It is the fault of this book that its scope is so severely limited to "political" events that such a simple explanation can be made to sound plausible. An analysis of the society over which Stalin presides must be part of any biography which is to help us understand the dynamics of his political leadership—leadership, it must be remembered, in a centrally planned socialist society which is in rapid transformation from newborn capitalism to full-scale socialism.

Although the book is a political biography, it does not offer any clear statement of what "politics" is in the Soviet Union. What are the decisions which reflect the use of state power to direct resources allocation? What is the structure of strategic power groups? What devices do they use to influence political decision-making? How do they resolve conflicts between the competing classes? The Stalinist revolution has produced a centralized, totally planned economy. The implications of this revolution on the formation of classes, the distribution of political power, and the nature of the political decision are not traced, however; there is not even an analysis of the nature of economic planning.

The book is one of the better one-volume political histories of the Soviet Union and, as such, will reward the interested reader; but it is severely limited as an analysis of leadership in the planning economy of the Soviet Union.

JULIUS MARGOLIS

University of Chicago

National Transportation Policy. By CHARLES L. DEARING and WILFRED OWEN. Washington: Brookings Institution, 1949. $4.00.

This work is the most vigorous and comprehensive work on transportation policy that has been published in recent years. In forceful terms the authors attempt to apply the current view that unification is a good answer to problems in public administration to the area of transportation in all its aspects—rail, water, air, and road. Thus the first fourteen of the sixteen chapters are devoted to outlining the confusion in transportation policy resulting from a multiplicity of agencies for promotion and control. The last two chapters construct the authors' solution, which is the combination of all executive and administrative functions in a "department of transportation," headed by a cabinet officer, and all regulatory functions in a "transport regulatory commission." Thus, although there is much in this book of great interest to transportation men, the study is, nevertheless, pointed primarily in the direction of public administration.

The authors take more seriously than any other recent writer in this field known to the reviewer the old-fashioned, but doubtless still valid and useful, classical doctrine that economic resources should be so allocated in a price economy that each enterprise and each industry stands on its own feet with respect to revenues and costs. No Keynesianism and no radical concepts regarding the use of the federal tax power

will be found here. The authors regard the present situation on transportation as an economic jungle in which everyone is busy promoting something to be financed mainly by the general taxpayer, by competing forms of transportation, or in some cases even some luckless shippers. In particular, the book makes out the railroad case for relief from heavily subsidized air, water, and highway competition much more effectively than the Association of American Railroads usually does. Very pertinent questions are asked as to what is meant in the Transportation Act of 1940 about preserving to each carrier a position commensurate with its natural advantages. Presumably, this is the key to national transportation policy today. Some startling things are noted. For instance, it is pointed out that on some feeder airlines the CAB policy results in the general taxpayer's contributing four times as much as the passenger who finds it convenient to ride a plane rather than a train or bus (p. 222). The railroads are obviously gleeful that they have at long last found an effective champion—one long needed. Conversely, air and water enthusiasts will be disturbed. But it is high time that someone spelled out the nature of the ridiculous and expensive promotional rivalry among government agencies.

The first part of the work is a general survey of government activities in promoting modern transport, emphasizing, in particular, air and water activities and giving some attention to highway development. Following an introductory chapter, the next three chapters deal with the confusion in air transportation. Much is made of the split in responsibility between the CAA, which plans the airways, the CAB, which authorizes the routes, and the Post Office, which pays the air-mail subsidies. The next chapter deals with water transportation and, in particular, with the expense and confusion resulting from the splitting of functions among the Army Engineers, the Maritime Commission, the Coast Guard, the Federal Barge Line, and some other minor interests. Then highways are similarly discussed. There follow two chapters dealing with issues and problems in government promotion. In general, the point is made that the multitude of agencies has not produced a national transportation system of optimum efficiency under conditions of either war or peace. They might have made the point, however, that rivalry and bureaucratic conflicts have produced, at least in part, that excess of capacity which has been so useful in time of war. A good case is made for centralization of responsibility in one agency, though possibly a case might also be made for competition among agencies as an antidote for lethargy and fixity of ideas. I am not entirely convinced that a reshuffling of offices is an adequate answer, unless it is accompanied by new legislative standards and a new point of view.

There follow six chapters giving a comparative study of regulation in the various fields of transportation under the subjects of operating rights, rates, fair competition, earnings, coordination, and consolidation. It is pointed out that, with respect to water and motor rights, the regulatory authorities have been zealous to prevent an oversupply of capacity and that "there is inherent in the regulatory process a tendency to resist experimentation, and consequently to slow down technical progress" (p. 192). On the other hand, the CAB, helped by wide discretion in the granting of air subsidies, has launched a severe overexpansion of trunk line and feeder air routes. Overhanging the whole problem is the corroding influence of subsidies, which undermine the will to obtain economic efficiency of both businessmen and government officials.

The book makes good, and at times highly interesting, reading, particularly because the writers do not hesitate to call a spade a spade. A defect is a tendency to oversimplify, but this is not serious. In particular, the work does not deal adequately with problems of fixed charges and the resulting discriminatory rate structure, especially in so far as rail-water competition is concerned. With respect to merchant shipping, the problems of economically maintaining a fleet reasonably adequate over a cycle of war and peace are not fully developed, though the enormous gap between wartime and peacetime vessel requirements is clearly the crux of the problem of shipping policy and justifies on economic as well as on security grounds a substantial amount of aid. It is high time, however, for the transportation problem to be subjected to keen and well-rounded analysis, and this work is an excellent opening attack. It should certainly be read by all concerned with this problem and should be a foundation on which many other studies can be based.

JOHN G. B. HUTCHINS

Cornell University

Has Market Capitalism Collapsed? By ALLEN MORRIS SIEVERS. New York: Columbia University Press, 1949. Pp. 387.

Professor Sievers' book is a detailed review of Karl Polanyi's *The Great Transformation*. The author's contributions are expressed as comments upon the earlier work; and, indeed, direct quotations fill an appreciable percentage of the 368 pages. All major aspects of Polanyi's thought are considered, including his interpretation of economic history, his views concerning the development of economic theory, and his positive program (never clearly expressed) for reconstruction.

This procedure would, of course, imply the author's very great respect for *The Great Transformation*, even if such respect were not explicitly expressed. The belief that he is commenting upon a major work, however, does not keep Sievers from indulging in substantial criticism of both the argument and the manner of presentation. Inconsistencies, exaggerations, careless use of language, lack of evidence, and lack of documentation of evidence are the general flaws pointed out.

The nature of the book makes it difficult to review Sievers without reviewing Polanyi also. Presumably, the first question concerns whether *The Great Transformation* is sufficiently important to justify so detailed a critique. Here a negative answer seems in order. The earlier work presents challenging theses and represents a brave attempt to fit the theory of economic development into the general stream of social anthropological thought. But, so far, its influence does not seem to have been very great. Certainly, it has not assumed the status of an "authority," so that disciples study its text for specific answers, as they do in the case of the great religious books, Washington's Farewell Address, *Das Kapital*, Marshall's *Principles* and *The General Theory*. Since this is so, a more general approach to Polanyi's thought would be preferable. *Has Market Capitalism Collapsed?* represents the material from which a more interesting and more valuable book could be derived.

This is not to deny merit to either work. While Manchester liberalism is almost defunct, and for generations critics have publicized the limited picture of man presented in formal economic theory, it is still common practice for both laissez faire and interventionist economists to talk as if the "economic" aspects of social life were somehow separable from the others. Moreover, those who formally criticize such separate analysis rarely attempt any large-scale integration, so that Polanyi's try must be considered helpful even by those who mistrust his loose references to "society" and society's "self-protection" and are skeptical of such of his theses as those concerning the role of high finance and the rise of fascism and national socialism. Similarly, Sievers' book is helpful, since it represents careful thought concerning the Polanyi theses and further stimulates thinking concerning the important issues involved. In general, Sievers' criticisms of *The Great Transformation* seem to be justified. The next to the last chapter, on Polanyi's positive program, is probably the least valuable. As is indicated above, precisely what Polanyi thinks or proposes is hardly the important question. Much greater significance is attached to the policy implications of his general theses (especially if the theses are believed to be valid).

It might be remarked, in conclusion, that much of the fascination of philosophies of history is attributable to bold statement of partial truth. What some critics have termed the "aesthetic merit" of Marx, Polanyi, *et al.* must be considered, as well as the strict logic of such writings.

HENRY M. OLIVER, JR.
Indiana University

Agriculture and Industrialization. By PEI-KANG CHANG. Cambridge: Harvard University Press, 1949, Pp. xii+270. $5.00.

This interesting addition to the literature on the industrialization of undeveloped regions addresses itself to the adjustments in agriculture which the process requires. The shift of factors between the agricultural and the industrial sector, the problems of adjustment within the economy, and the relations to more-developed areas are the main themes of the study. After a lengthy Introduction about concepts and methods, the author examines food and raw materials as a connecting factor between land and industry, paying close attention to the link between population, labor, and the location of activities. A general section on industrialization retraces familiar developments previously covered by Hoffmann, Colin Clark, and others.

A chapter on the effects of industrialization on agriculture seems the most valuable contribution of the book. Marshallian and Robinsonian analysis is used to illustrate the mutual

effects of elasticities of demand and of substitution, of prices of factors and products, and as stimuli or deterrents to mechanization. The subsequent treatment of farm labor as a factor of production along traditional lines deliberately disregards all but economic aspects. An all-too-short outline of the beginning of industrialization in China is followed by a review of international capital movements and the trade relations between industrial and developing countries. Some interesting glimpses are provided, e.g., about the imperfections of rural buying and selling and certain locational factors.

The author concludes that industry is a necessary condition of agricultural reform, as a supplier of the means of improvement and as an outlet for its products. Improved transport and progressing social and institutional climates are also necessary. The limitation of agricultural development, compared with industrial expansion, accounts for largely unpredictable reciprocal effects. Differences of physical factors and degrees of development affect the economic relations between old and new industrial countries, causing a need for frequent and mutual adjustments.

This book's usefulness is impaired by the author's fondness for elaborate definitions and a full exposition of quite peripheral points of theory. This technique is bound to confuse the casual reader and to distract the economist naturally familiar with economic principles; he may well feel disappointed by the anticlimax of conclusions from lengthy theoretical discussions which, in fact, do not always seem to require such an involved foundation.

A few points of detail could be singled out for criticism, but more serious seems the neglect of the differentiation between self-sufficient subsistence farming, large-scale plantation (or "estate") economy, and "industrialized" agriculture without prominent urban industrialization. It may also be regretted that an economist's self-constraint prevented the author from dealing with the sociopolitical aspects of the shift of labor to the factory and similar problems; there are many economic consequences to "extra-economic" phenomena of industrialization, such as the effects of urbanization on consumption-and-savings habits and of education on the stratification of demand.

In all fairness to Mr. Chang, it should be stated that his book is more than just an exhibition of his great erudition; at this time, when development has become an issue of global politics, any such brave attempt to gather the innumerable loose ends of theory has its value. It is true that this work lacks the concise reasoning of the studies of Mandelbaum, Rosenstein-Rodan, or A. J. Brown and the factual and comprehensive presentation of Hilgerdt or Staley; it has certainly none of the sweeping vision and statistical wizardry of a Colin Clark. We cannot, however, blame Chang for not having filled single-handed the crying need for a complete theory of economic development. It will have to be a dynamic theory of growth of which the barest outlines are beginning to be perceived by Harrod, Domar, and others. It may take a generation of economists to complete it. In the meantime, books such as Chang's, regardless of their imperfections, will be studied carefully for the information they provide.

HENRY G. AUBREY

New York City

Pressure of Population and Economic Efficiency in India. By D. GHOSH. Madras: Oxford University Press, 1948. Pp. 109. $2.00.

Three contemporary events, India's new independence, the United Nations program of technical aid for the economic development of backward countries, and President Truman's suggested Point Four program, all serve to give especial importance to this vigorous little book. Economic aid to oriental countries which cannot and does not check their birth rates may well deserve the term "operation rathole"; while political independence without economic advancement will leave India's problem unsolved. D. Ghosh has no desire to evade the implications of his country's tremendous population problem. As he says, "the first step in the solution of our population question is to get out of this stage of obscurantism."

The volume represents the union of demography with economic analysis and is divided into three concise parts, devoted to (1) the structure and growth of India's population; (2) the impact of increasing numbers on the economy, especially agricultural and industrial productivity; and (3) the future rates of population growth and economic progress. Especially tense and rigorous are Ghosh's analyses of India's demography and her backward economy. If the third section seems unduly weak, it must be because there is no adequate theoretical model for

analysis of the industrialization of an undeveloped economy.

The population facts are stark, simple, and well known. A population larger than that of Europe minus Russia (389 million in 1941) "breeds and dies lavishly and lives at a low level of economic achievement." A mortality rate at which one-fifth of all infants die before age one and 50 per cent of the population are dead before age twenty makes tolerable an incredible birth rate that reaches 40–45 per 1,000. Obviously the first public health achievement of the new India will be to lower its fantastic mortality rates, and yet this is a victory that the Indian economy can ill afford.

India is notoriously overcrowded; the average size of farm is 5⅓ acres, and per capita income in the United States is twenty-two times that in India. The first effect of industrialization is to push tremendous numbers out of the traditional handicrafts back into agriculture. For each worker that finds employment in a textile factory several lose jobs in the cottage industries and village looms. Ghosh knows well enough the factors required for economic development but has little hopes of their application. Capital is hoarded in rural India because high density gives no scope to its investment in mechanization and large-scale agriculture. Family limitation on a nation-wide scale is essential to stabilize population growth; while only a program of industrialization on a scale large enough to draw large numbers from the countryside could improve the position of agriculture. Industrialization requires both capital and markets, two things India lacks. The reader is left with the question: What is the economic catalyst in undeveloped countries?

RUPERT B. VANCE

University of North Carolina

Dynamic Equipment Policy. By GEORGE TERBORGH. New York: McGraw-Hill Book Co., 1949. Pp. 285. $3.75.

This book deals with the economic justification of replacing capital equipment. The analysis has been undertaken by the author as research director of the Machinery and Allied Products Institute. The study has the indorsement of this trade association.

In the course of developing his own replacement formula, the author necessarily covers a ground common to numerous other writers. The questionable features in various popular replacement formulas and procedures are pointed out and evaluated.

Correct equipment policy is defined as "the policy that minimizes the time-adjusted sum or combined average of capital cost and operating inferiority." The analysis incorporates concepts of an "adverse minimum," "operating inferiority," and "sunk cost." The original investment in the "defender"—the machine subject to replacement—is treated as a sunk cost; that is, as a past and irretrievable expenditure. This treatment divorces the machine from considerations of book value. The defender is evaluated at its estimated present and future salvage, or resale, value; and two related costs are recognized. One cost represents estimated periodic decrease in salvage value; the other cost is a memorandum carrying charge on the estimated salvage value at the beginning of successive periods. A similar type of derivative capital charges is established on the "challenger"—the machine endeavoring to displace the defender.

"Operating inferiority" is the differential between the variable costs of the inefficient defender and the efficient challenger and also between the challenger's future and first-year variable costs. Once the derivative capital charges and the operating inferiorities have been determined, the next step is to establish the "adverse minimum" for each machine being compared.

The "adverse minimum" is defined as "the lowest combined time-adjusted average of capital costs and operating inferiority obtainable from the machine." When the machines compared have the same time span, the discounted values, or adverse minimums, are described as directly comparable. This appears reasonable. The author considers that, when the service periods of equipment compared differ, as they usually do, "their averages [uniform annual equivalents] are comparable, however, for different time spans," and the definition of adverse minimums in terms of averages is proper. This use of averages appears questionable, since it leads to an inaccurate present value as compared to the discounted individual components.

The danger to an individual firm, or to a nation, in not maintaining modern plant and equipment is discussed, with Great Britain as an outstanding example. American management is taken to task for lack of discernment in its equipment replacement procedures and policies.

In summary, *Dynamic Equipment Policy* is lucid and stimulating; and it is an important contribution to the field of capital replacement policy and practice. But it is by no means gospel.

HUGH N. EMERSON

University of Pennsylvania

Labor and Management in a Common Enterprise. By DOROTHEA DE SCHWEINITZ. Cambridge: Harvard University Press, 1949. Pp. xii+186. $3.00.

The "common enterprise" was the recent war effort; and the production committees, encouraged by the War Production Board, the vehicle for labor-management co-operation. The history of these committees can be read as a step "toward the solution of the problem of liberty in a democracy" (p. 9), as does Miss de Schweinitz; or, and perhaps more properly, as a commentary on the current character of collective bargaining in the United States.

About five thousand production committees were established during the war. Miss de Schweinitz was close to their operations when she served as an official of the War Production Board; and, after the war, through the facilities of a Wertheim Fellowship from Harvard University, she reviewed the record. She sets forth what will no doubt be the definitive discussion of the work of these committees. She describes most competently their history, procedures, and functions. She also comments on their future and expresses the opinion that labor-management committees "may be the route toward the achievement of order and equity without loss of liberty" (p. 175). If the future really holds this prospect, it must be a quite distant future; for the important fact is not that production committees were established during the war but that they had so little influence and disappeared with so few traces.

The five thousand committees operated in only one in ten or twenty of the total plants covered by collective agreements. Nor did they make basic decisions when they were active. Their activities fell almost entirely into four categories: (1) the sharing of information by managers with union representatives, (2) the consideration of methods for increasing efficiency, (3) the discussion of devices for reducing manpower problems such as absenteeism and turnover, and (4) the prosecution of community interests such as war-bond and blood-donor drives. The last type of function was the most important. The committees were advisory to management, and management retained the power to decide.

The committees were a hothouse growth—a product of the war. Once the war was over, 95 per cent of them promptly disappeared. Management generally took the initiative in discontinuing them, but the unions did not press strongly for their continuance. One of the most useful chapters in the book analyzes the reasons for their abandonment: the desire of management to retain its traditional rights, the need of union leaders to act combatively, the inclination of workers to restrict output, the difficulty of measuring and distributing agreeably any cost savings, and the frequency of hostile collective-bargaining attitudes.

This withering on the vine is quite in contrast to developments in a number of western European countries where, by voluntary agreement or by law, labor-management committees have been perpetuated or increased in the post-war period and given significant power. This contrast again emphasizes the essential conservatism, comparatively speaking, of management and unions in the United States. Companies do not generally permit, nor do unions usually desire, any great participation of organized labor in the management of the enterprise. Labor-management committees in the United States spread so fast during the war only because they did so little.

CLARK KERR

University of California

Economic Planning: The Plans of Fourteen Countries with Analyses of the Plans. By SEYMOUR HARRIS. New York: A. A. Knopf, 1949. Pp. xvii+577. $4.50 (text), $6.00 (net).

Professor Harris has gathered into one volume lengthy extracts of easily accessible official planning documents of fourteen countries. These are preceded by one hundred pages of analysis and background by Harris and by brief statements introducing each plan. The author says that it is not his "intention to write a learned discourse on the theory of planning"; instead, his "objective is to reproduce the plans and to suggest the background, the essentials, and the similarities and dissimilarities of plans." But, since his purpose in presenting the plans is

to enable us to direct more intelligently the development of planning procedures, he cannot avoid the necessity of providing tools by which to evaluate the plans if his end is to be achieved. This neglect of the theory of planning makes the volume mainly useful as a reference in that field called "comparative economic systems." The plans provide excellent descriptive materials illustrating the different economic policies and objectives of nations, the degree and types of government controls, the mechanics of planning administration, etc. Harris' introductory chapters provide a workman-like though skimpy survey of the many problems confronting the nations. Among these problems are productivity, industrialization, reconstruction, inflation, and international economic relations.

Initial difficulties confronting any study in economic planning are the definition of the concept of planning and the understanding of the important problems involved in planning. Planning as understood by Harris is the supplanting of the entrepreneur by a government board. This concept provides no basis for evaluation except the degree of controls which are themselves consistent with both "poor" and "good" planning; it involves a confusion between a mechanism and a set of criteria used in performing operations. This is a common and depressing feature of the literature of planning. A proper analysis of plans necessitates handling of the classic problems of economics in terms of the techniques of planning. Two such problems, convenient for illustration, are those of the determination of allocative efficiency within the goals of the society and the effectuation of an agreement between the consequences of actions and the desired ends.

An example of the error in confusing mechanism with criteria is seen in the author's handling of the Soviet Union. Consistent with his understanding of planning, he states that "in the U.S.S.R., the economic plan has reached its highest state of development" (p. 17). It is true that the U.S.S.R. has achieved the greatest degree of direct management, but this does not assure any greater efficiency in achieving its goals than might be the case in a laissez faire or mixed economy. Implicit in the author's formulation is the assumption that efficiency will follow the increases in government controls because, as he thinks, the U.S.S.R. would neither dissipate its manpower in the operations of selling and distribution, nor tolerate the restrictions and waste of monopolistic competition, nor make an error like that of the United States in allowing three million university students when only half that number would be absorbed by the market (pp. 6–7). (In later pages, though, Harris states that inefficiencies in Soviet planning in the past have led to wastes [p. 18].) At no place in his analysis of Soviet plans or in the plan quoted is there any evidence that the increase in government management will reduce waste, to say nothing of assuring efficiency.

Though all the plans are political documents of great interest, they are of unequal value for the purposes of the volume. Some are simple statements of goals and give few clues as to the nature of the planning undertaken for the purpose of implementing the goals. For a few countries, speeches and pamphlets by officials have been substituted for the official plans. A familiarity with planning in the fourteen countries would be gained more readily and less tediously if there had been a more judicious editing of the many details of the official plans. The inclusion of authoritative articles or statements in their place would have given the reader a more fruitful insight into the many forms that planning has recently taken.

Economists, who have long suffered the indifference of the politician to their advice, may be encouraged to learn that Harris considers their theoretical advances as a contributing force in the development of planning. He believes that, along with Russia's experiences, the partial breakdown of capitalism in the interwar period, and the aftermath of war, which he says are the more important explanations, "undoubtedly, the theoretical advances in planning economies offered by Lange, Taylor, Schumpeter, Dobb, Lerner, Lorwin, Sweezy and others had some influence" (p. 16).

JULIUS MARGOLIS

University of Chicago

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